vol. XVI no. 8

APRIL 1957

School Shop

Tool, Material, and Project Storage Portfolio

Suppliers Directory
New Instructional Materials
Directory of Officials

Cover story: San Francisco public-school students in the center dramatize the necessity for good storage facilities. No matter what the shop, efficient and educationally sound storage procedures make for a better administered school shop. See pages 2-74 for ideas on how to handle the storage of tools, materials, projects in your shop.

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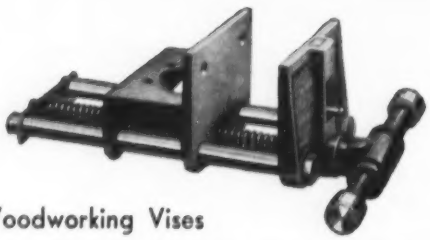

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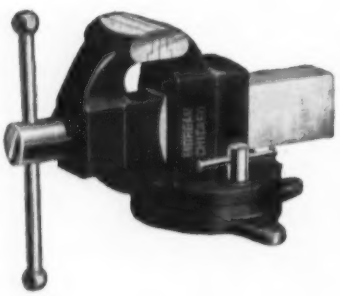

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School Shop TALK

COMMENTS ON ISSUES FACING INDUSTRIAL EDUCATION

Too Little Too Late

The problem of storage receives too little attention when school shops are being planned. This notwithstanding the fact that lack of storage facilities frequently creates confusion in the shop and seriously interferes with effective administration.

Tools must be stored in a manner that permits easy access to them, and assures that each item has a definite resting place. Material must be stored so that the students can obtain what they need without disturbing too much of the total supply. Effective storage of supplies, too, is important since it is distressing when you are compelled to search through a number of receptacles before you find the item you are seeking. And an effective system of storage of unfinished work is a necessity if the teacher wishes to avoid the annoying experience of deciding the ownership of a particular part, or has to assist in the search for parts that have been mislaid. In general the provision of adequate storage facilities frequently marks the difference between a good teaching situation and a poor one.

Not all teachers will solve the storage problem in the same way, of course. Each teacher should have a plan for dealing with it which fits into the conditions under which he is teaching. This is a *must* if he hopes to avoid the difficulties that are sure to arise if such a system is lacking.

In this issue there are presented a number of ideas concerning storage which have been collected from various sources. It is not expected that these suggestions will fit into the conditions prevailing in all shops. However, they may be modified to meet the needs of any teaching situation.

Teachers are urged to review their storage facilities in light of the ideas presented here and to make use of any of the suggestions they feel will improve their present arrangements. Those teachers who have already solved the storage problem satisfactorily will be happy to compare their present arrangements with the ideas suggested here. Other teachers, who find that their present systems lack efficiency, may be inspired to modify them as a result of studying the suggestions made by our authors. In either case it is hoped that the attention given by SCHOOL SHOP to the need for proper storage facilities will remind our readers that many of their problems, as teachers, arise from a lack of conveniently and efficiently arranged storage space.—*T.D.*

A Stitch in Time

While shop planning has made great strides in the last decade, a recurring problem with new facilities is adequate storage space. False economy is often sought through cutting down on floor area which is really essential for storage and efficient operation of the school shop.

Storage is as important and integral a problem of shop planning as the provision of work stations, machine space, or any other more commonly thought of aspect of planning a new shop. Tools usually get some consideration when storage is discussed by school planners, but materials and projects under construction are frequently overlooked or given considerably less space than they are entitled to in an efficiently planned shop. With many shops being used both day and night the problem is compounded.

Most shop teachers are aware of this need but are so enamored of the idea of new facilities that they fail to press for adequate storage arrangements. Architects and school administrators go ahead with plans without real knowledge of the need for such space. By the time the shop teacher gets his licks in for sufficient space, the architect and administrator are trying to make cuts so the building will come within the allotted funds.

The moral is, of course, that shop teachers and supervisors should make architects and school administrators aware of this problem well in advance of the issuance of final plans and insist that adequate provision is made for tool, material, and project storage. The material in this issue of SCHOOL SHOP is made to order for just this purpose.—*L.W.P.*

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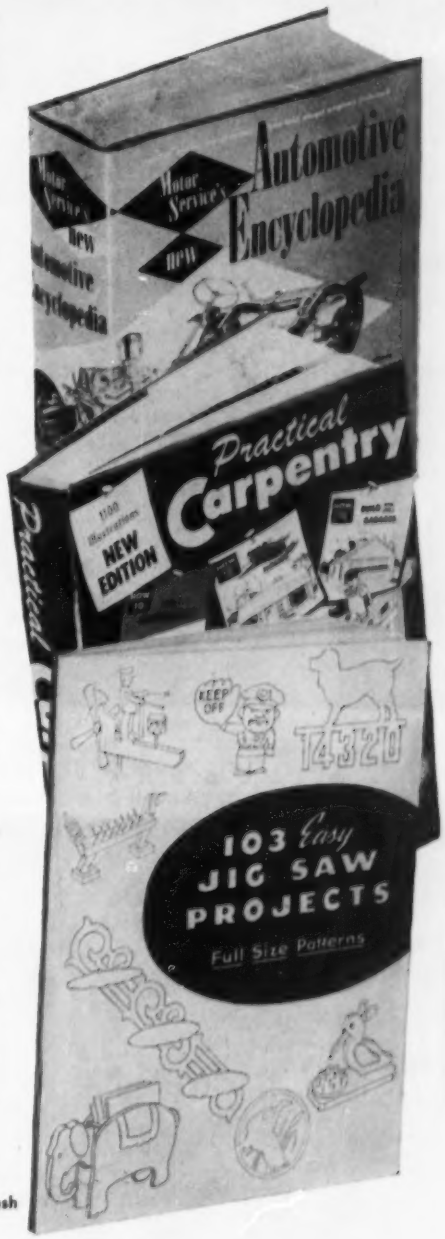

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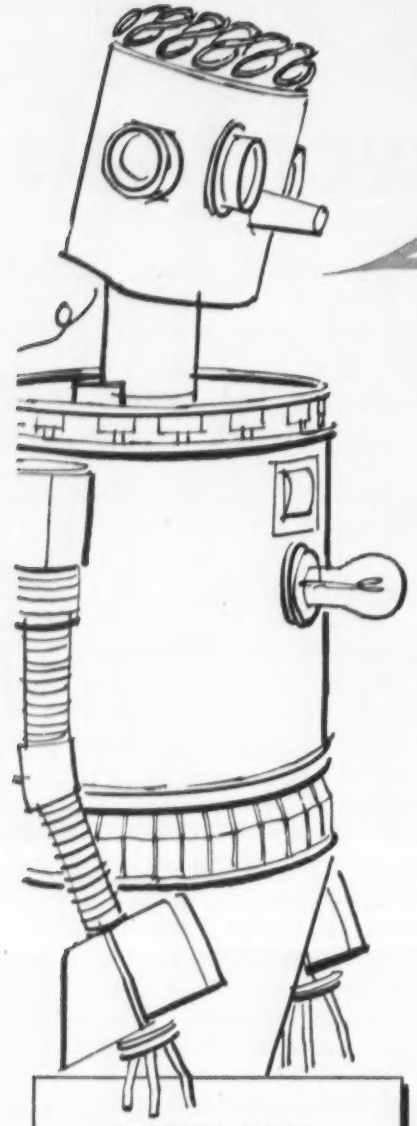

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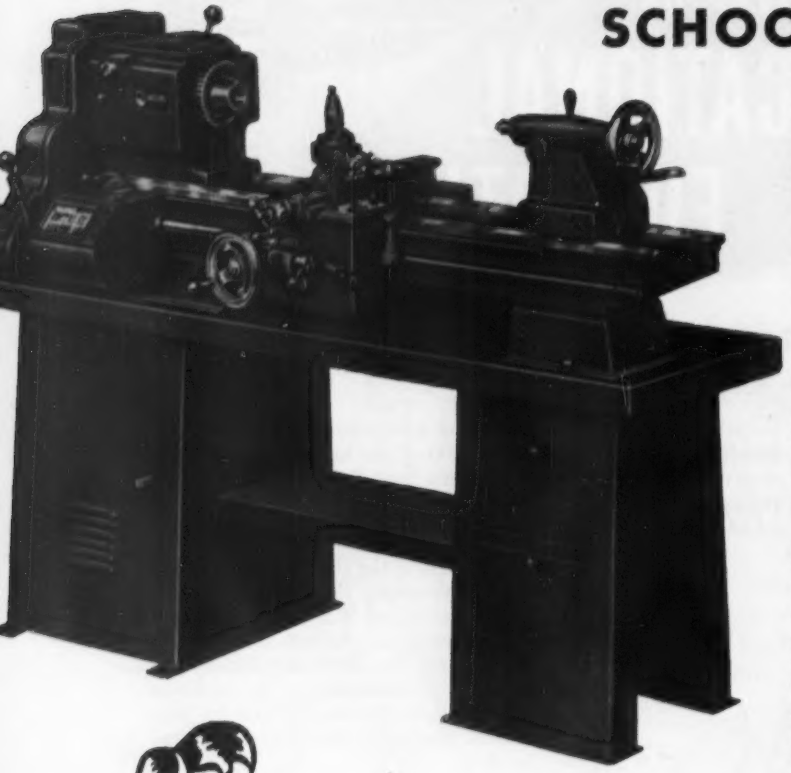

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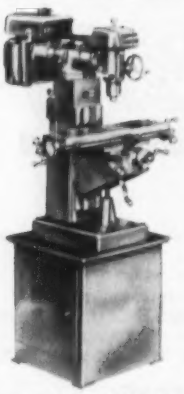

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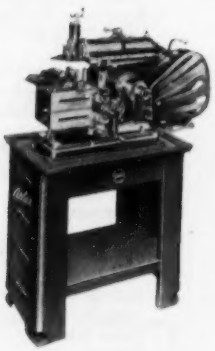

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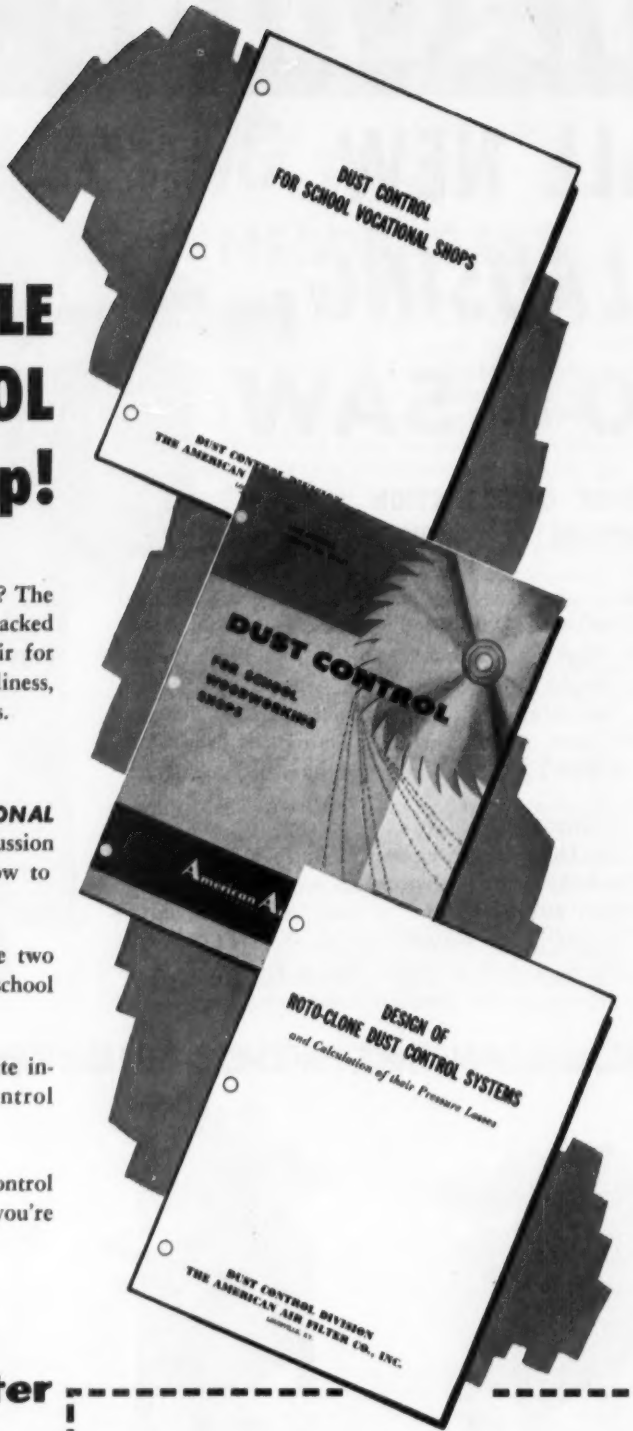

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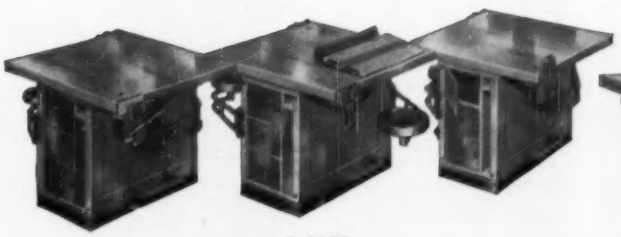

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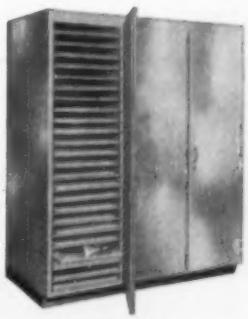

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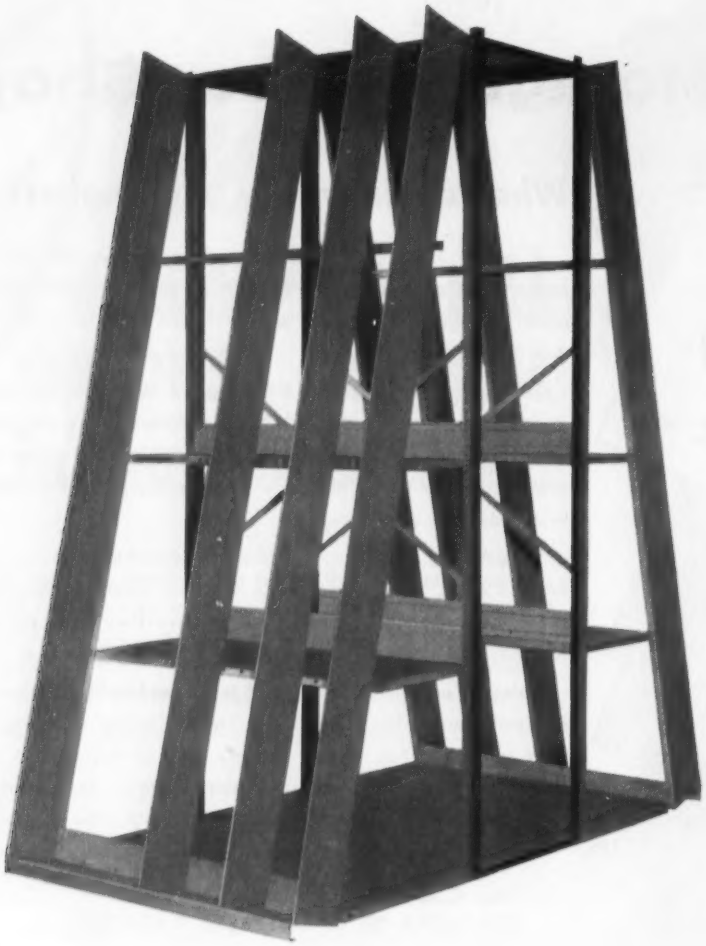
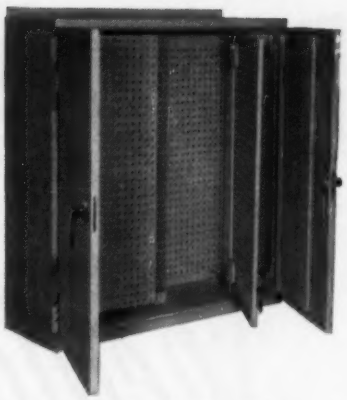
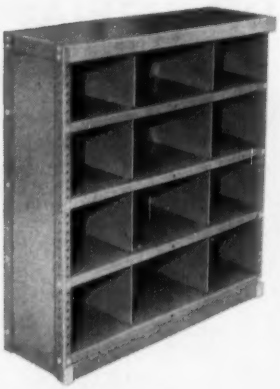


Vertical Lumber and Metal Storage Rack. Holds 12 to 14 ft. lengths of lumber, pipe, bar stock or conduit in the vertical compartments. Three shelves are provided for shorts. Base shelf is 24 in. deep, intermediate shelf 18 in., and top shelf 12 in. Triangular unit is 4 ft. wide, 34 in. deep at base. Rectangular plywood storage unit is 24 in. deep, holds sheets on 4 ft. edge.



Tool Storage Cabinets. Wall and floor types, with all-steel pegboards. Wall type has pegboard area of approximately 24 sq. ft., floor type approximately 65 sq. ft.



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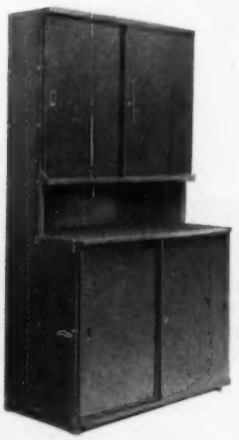

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JENKINTOWN PENNSYLVANIA

Educational Implications of Storage Methods

By Gordon O. Wilber

Director, Department of Industrial Arts,
State Teachers College, Oswego, N.Y.

THE alert industrial-arts teacher of today is making extensive and effective use of tool and material storage methods to further the educational outcomes of his program. A knowledge of the tools and materials of modern industry and crafts is recognized as one of the desirable objectives of industrial arts. As a consequence, the teacher is using every device at his command to make students aware of, and to impart information concerning, supplies and equipment commonly used in the laboratory. A brief review of the trends which have developed over the past few decades in methods and practices of tool and materials storage will help to clarify this point of view.

When manual training was first developed in the public schools, an important consideration was the protection of tools and materials from being stolen or lost. The teacher looked to industry for an answer and found that tool and stock rooms were almost universally used. It was only natural to copy these in the school shops. The tool crib and the locked storage became, as a consequence, a familiar fixture of the manual-training shop.

Tool Storage Systems

Many methods were used to adapt the tool crib of industry to school use. A common practice was to assign a number to each student in the class and then provide a supply of metal checks or discs to each boy bearing his identification number. When a boy wanted a tool he applied for it to the "tool-room boy" who produced the required item and in its place hung a check with this particular boy's number. As tools were returned, checks were replaced in the rack or returned to the boy. By this method it was a simple matter for the person in charge of the crib, or for the teacher, to check if a tool were not returned. A variation of this scheme was used in other shops where the tool-crib boy was provided with a pad or form on which he kept a written record of the tools which were charged out, and checked them in as they were returned. It was held that this system helped the tool-crib boy to learn the names of tools and how to spell them. (A check of some of these old records which recently came to my attention seems to indicate that the results were not entirely successful.)

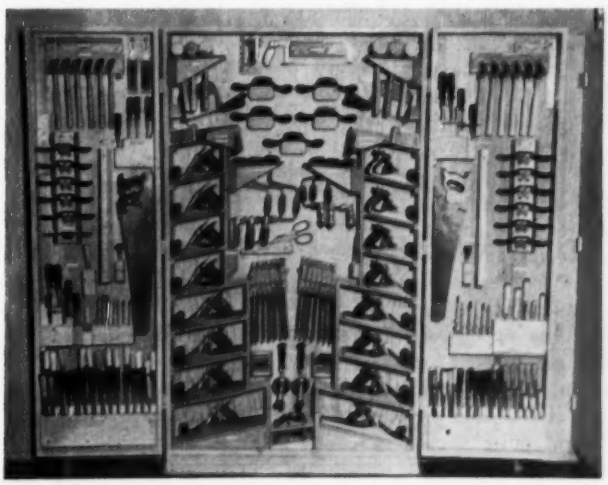
It should not be assumed that there are not many desirable features in the use of a tool room. This is especially true in cases such as a large machine shop or auto-mechanics shop where the possibility of loss of precision tools and instruments is a factor that outweighs other considerations. In general, arguments which may be cited in favor of the separate tool crib are:

1. All tools are centralized in one place and students know exactly where to go for them.
2. The room may be locked, providing a second barrier in case of a break-in.
3. A student may be assigned to the tool room and be held responsible for checking out and return of tools.
4. A tool room provides (under certain circumstances) protection against the unauthorized borrowing of tools by the janitorial or maintenance staff.
5. The use of a tool room simulates the practices of industry and, to some extent, may be assumed to contribute to occupational exploration.
6. There is some control over the use of certain pieces of equipment and instruments which should not be made available to all students.
7. It is possible in some cases to hire a tool-room man and make him responsible not only for the checking in and out of tools, but also for their maintenance and upkeep.

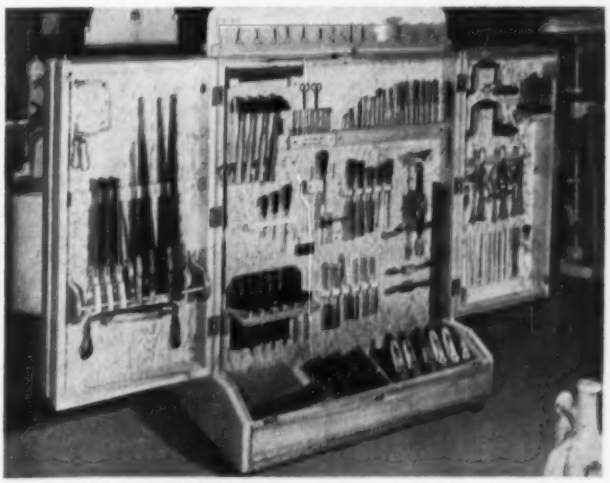
Panels Now Popular

On the other hand, during the past two or three decades there has been a decided trend away from the centralized tool crib and toward the use of tool panels within the laboratory. These

Casters support the doors of this wall cabinet in the Fulton Junior High School, Los Angeles, Calif. Labels identify tools. Cabinet may be locked.



Open-panel cabinet on wheels used at the St. Johnsville Central-Rural School, N.Y. Tools are available where needed, thus avoiding congestion.



panels take a variety of forms depending on local situations, the type of shop or laboratory, and the ideas and imagination of the teacher.

An intermediate step between the closed tool crib and the open panel is the wall cabinet. Variations of this method of storing tools are found in many schools. Such cabinets have most of the advantages of the open tool rack and at the same time permit tools and equipment to be under lock and key when the room is unattended.

By far the most popular method for storing tools today is the completely open panel. Two types of open panels will be found in common use. A single general tool panel is frequently used in the small one-teacher situation. This panel, usually rather large in size, provides storage for most common tools used in the laboratory. In a comprehensive general shop one may find on such a panel tools used for woodworking, metalworking, electricity, and all of the other areas represented within the activities of the laboratory. Evident advantages of this system are that all tools are in a central location, and that there is only one panel to be checked at the end of the period.

Within recent years, however, there has been an evident trend toward still further decentralization and the use of specialized or area tool panels. This has been particularly true in the many variations of the general shop. For example, one now finds the woodworking tools concentrated on a panel near the woods area, the metalworking tools near the metals area, and the craft tools near the place where they will be used.

In many instances, this trend toward greater decentralization of tool storage has been carried even further. Tools and equipment which are to be used with a given machine or bench are located adjacent and convenient to it. Thus, all of the chucks, tool holders, wrenches, etc., to be used on a lathe may either be mounted on a panel attached to the frame of the lathe itself or on a cabinet or stand nearby.

In some cases the tool panel is movable. This method of storage seems especially adapted to the auto-mechanics or transportation shop where a given set of tools may be needed alternately in different parts of the room. Teachers and consultants in elementary industrial arts have also found the mobile panel or cabinet useful in transporting tools from one classroom to another.

As in the case of the separate tool crib, there are many evident advantages which accrue from the open method of tool storage. Important among these are:

1. All tools are in the open where they can be easily checked by students or teacher.
2. Avoids congestion which frequently occurs around the tool-room door at the beginning and end of the periods.
3. Permits the display of tools and equipment as a motivating and educational device.
4. Eliminates much of the running back and forth in the laboratory caused by the necessity for going to the tool room for each new tool needed during the period.
5. Eliminates the necessity for assigning a student to the tool room where learning experiences are limited.
6. Creates an attractive and interesting atmosphere in the laboratory (if tool panels are properly placed and organized).
7. Saves student time since tools are near at hand.
8. Decreases the possibility of accidents due to students passing near others who may be working with potentially dangerous tools or machines.

Low level of these wall panels, which utilized unused space, is not a handicap at the Harding High School, Warren, Ohio. Lockers are at rear.

Variations Usually Desirable

It should be evident that the storage of tools within the shop is not an "either-or" situation. In actual practice there is frequently a use both for the closed tool room or cabinet and for the open panel. This is particularly true where the work requires a large number of expensive tools, delicate equipment, or equipment with large numbers of small parts or attachments. In such cases, it is usual practice to keep such equipment under lock and key, while the more common and less expensive tools are placed on open panels.

Another variation of the tool crib and open storage is the use of tool kits or boxes. Under this system, more commonly used tools are made up in the form of a bench kit, making tools readily available at the place where they are to be used, and at the same time the kits may be returned to locked storage at the end of the period or day. In most cases, however, the use of kits leads to an unjustifiable duplication of equipment.

It should be evident from the preceding discussion of various methods for organizing and storing tools within the industrial-arts laboratory that there is no one universal or best method. The final decision as to which should be used will depend on such factors as:

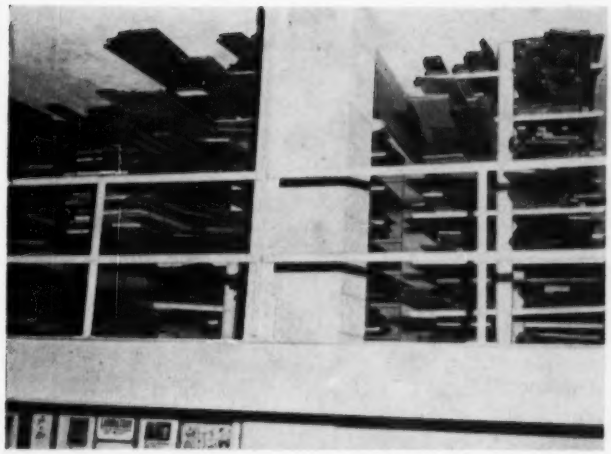
1. The types of activities to be carried on in the room.
2. The size of classes to be accommodated.
3. The type of personnel organization to be developed and used.
4. The extent to which the loss of tools is an important factor.
5. The janitorial and maintenance force problem.
6. The educational philosophy and methods of the teacher.

Materials Storage

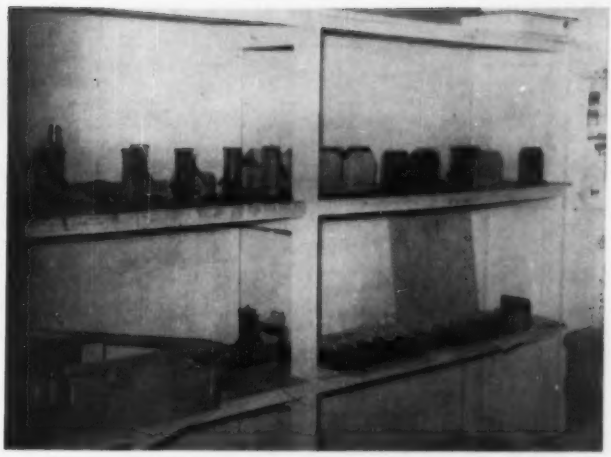
Any discussion of materials storage must of necessity be in broad general terms. Every industrial-arts laboratory has on hand literally thousands of items, each of which presents its own problem of storage. Here are some general considerations which have definite educational implications:

There are two general methods of storing and administering supplies. The first of these might be termed closed storage. Under this system nearly all of the materials are kept either in a locked storeroom or in locked cabinets. The teacher controls the key and, in most cases, gives out the supplies as needed by individual students. The evident advantage of this system lies in the fact that the teacher has complete supervision of all supplies and can dispense them to those who need them at the time that they are to be used. Without question this is the most economical method, and where there is a very limited supply budget or where strict accounting is required, may be the only possible answer. However, I have observed many situations where it appeared that the teacher spent more time in unlocking and locking cabinets and in handing out supplies than he did in instruction.

The opposite of the closed storage is the completely open storage. Under this system, all cabinets and storage areas are open during the time that classes are in session. Students are free to use such supplies as they may need without spe-



Balcony space is used extensively at Harding High School, Warren, Ohio, for storage. Racks are placed so stock is accessible from both sides.



Project storage and finishing room are combined at Weston, Ohio, High School shop. Shelving is spacious enough to hold most projects.

cial permission. This system saves much of the teacher's time, but is usually found to be expensive in terms of wastage and loss of supplies.

Some combination of the open and closed methods of supply administration is usually the answer in specific situations. In some cases the larger and more frequently used materials like lumber, sheetmetal, etc., are placed in open storage, while smaller and less often used materials are kept in closed cabinets or storerooms. Even this compromise, however, has been found to make unusual demands on teacher time. As a result, many instructors have included a supply clerk in the student-personnel plan and have delegated to him the responsibility for giving out and supervising the use of materials and supplies. The success of such a system appears to depend on how well the class is organized, and the extent to which the teacher can delegate responsibility and check on the thoroughness and efficiency with which the clerk carries out his duties.

A further word might be said concerning the general problem of materials storage. One finds almost complete agreement among teachers of industrial arts that architects and school planners seldom provide enough storage space when planning new shops. While the situation is probably not as critical in the large cities where there is likely to be sufficient central storage for most large supplies, in the one- and two-teacher schools, where all storage must frequently be within the school plant, steps need to be taken to make adequate provision. In most cases initiative must be taken by the teacher or supervisor to see that the architect and others are fully informed concerning the necessity for convenient and ample storage space. A minimum of from 5 to 15 percent of the area of the shop proper is not unreasonable and for certain types of work should even run higher.

Project Storage

The storage of partly finished and finished projects is always a problem for the industrial-arts teacher. The loss of, or damage to, a partly finished project (which frequently involves hours or even weeks of work) is a serious situation for both teacher and student. Realization of this has led equipment manufacturers to make a concerted effort toward its solution. Many types of benches have been developed which include locker space designed for project storage. In cases where shops are equipped with the earlier type open-base benches, this space has been used for built-in storage lockers. This move has helped to solve the problem of safeguarding projects and, at the same time, achieved a better looking and more easily cleaned laboratory. In other situations, either steel or wooden cupboards, cabinets, or lockers have been installed as a partial solution.

A more complete and permanent answer to project storage has been noted in many new buildings (especially in the Far West). These shops have been so designed that one complete wall is given over to individual lockers up to a height of six or seven feet. While the loss of valuable wall space may be decried, it does solve a difficult and sometimes an embarrassing problem for the teacher. Adequate locker space in a corridor convenient to the shop has also been used effectively in some schools as an answer to project storage.

Adult Classes

Problems of storage have been aggravated in recent years by the increasing number and size of adult classes using the industrial-arts laboratories. Generally speaking, the projects attempted by adults tend to be larger and more complicated than those of the industrial-arts student. This is particularly true in the woodworking area were problems in the refinishing and upholstering of furniture are common undertakings.

I have seen many instances where the regular industrial-arts activities have been severely handicapped by the necessity of working on benches already overcrowded by projects left by an adult class. This is a situation which needs attention by both the teacher and school administrator. It seems logical that, if adults are to use facilities planned for industrial-arts students, a convenient and adequate storage for unfinished work should be provided.

In many cases this is difficult to achieve in a building already in use, but certainly where new facilities are being planned adequate provision should be made for storage outside of the regular shop area.

There does not appear to be a clear-cut solution to the many problems of tool and material storage which face the industrial-arts teacher. Every situation is different and calls for an individual answer. However, the industrial-arts teacher should appreciate that the efficiency of his program will depend greatly on the extent to which he can develop an effective system. In the years ahead when many new industrial-arts laboratories will be planned and built, the problems of storage should be given careful consideration. The industrial-arts teacher must take the initiative in educating architects and school administrators concerning the need for adequate space allocations for this important aspect of the industrial-arts program. ★

Operational procedures for, and instructional values from,

Tool Storage

A. A. Vezzani

Chief Technical Adviser, Centro de Adiestramiento de Operadores, Mexico City, on loan from Department of Vocational Education, University of Michigan, Ann Arbor*

A SCHOOL shop tool storage facility has two major functions to fulfill: one is to provide an efficient medium for the care, study, checking, and storage of tools; the other is to give the student practical experience in methods of tool control. Therefore, in a school system where more than one shop is involved in the student's program of studies, it behooves administrators to use several methods for the storage and checking of tools, thus making this experience a truly instructional unit in the curriculum.

Tool Storage and Control as an Instructional Unit

Through a well planned and operated series of tool storage facilities the student can learn (1) correct names of common tools, (2) names and uses of special tools, (3) maintenance of tools, (4) methods of mounting tools, (5) methods of controlling tool issuance, (6) use of tool checks, (7) tool storage systems used in industry, (8) operation of a tool crib, (9) responsibilities of the tool keeper, and, if provision is made for such instruction, (10) cost of tools, (11) use of tool catalogs, and (12) proper use of tools.

In cases where the tool storage facility is a tool crib, the student can learn as the tool keeper the responsibility of caring for the tools and also the necessity of getting along with the students he serves. For the time spent in the tool crib, the student is graded on his ability to perform this task effectively and the same factors are used in arriving at this grade as for other shop jobs performed. Through the use of a job sheet, the things to be learned by the tool keeper can easily be called to his attention. Where the student spends one period each semester in the tool crib, the learning items become more difficult as the student progresses in his program.

Open-panel and cabinet-type tool storage facilities also provide a source of many experiences for the student. In such cases the class as a group assumes responsibility for the care, proper use, and policing required to see that tools are not damaged or lost.

Types of Tool Storage Facilities and Their Use

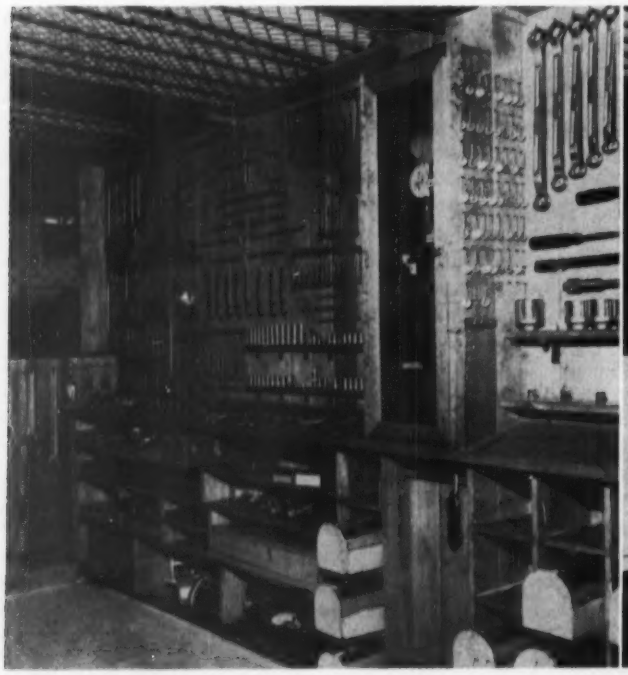
Tool storage facilities may be classified as follows:

1. *The tool crib* is an enclosed area with a heavy wire mesh as the top portion of the enclosure and wood, brick, or concrete wall as the bottom portion. Use of wire mesh provides for good lighting and enables the teacher to supervise what is going on in the tool crib from any section of the shop. The wall on the lower portion permits the construction of shelves or racks for the mounting of tools.

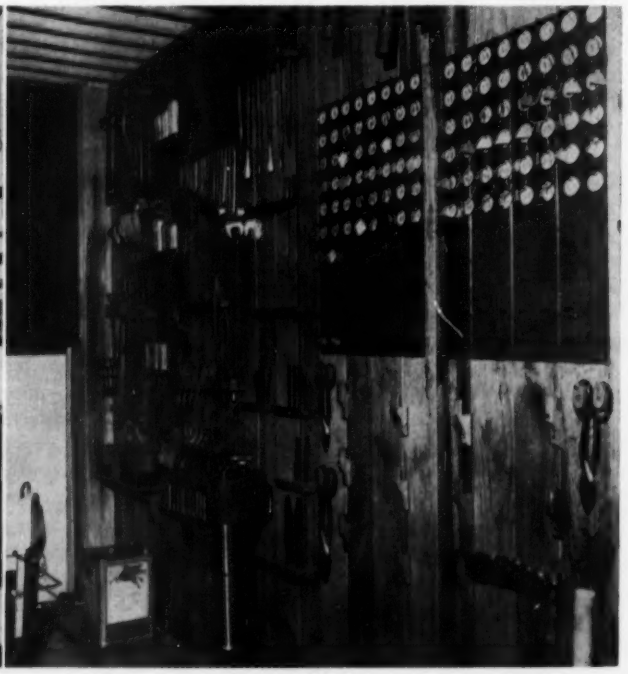
This type of facility requires an attendant (tool keeper) who may be employed where adults or evening classes use the shop or may be one of the students, as is usually done in day-school programs. In the latter case, the student

*Storage facilities shown in this article were designed by Howard Gerrish, University High School, and Professor Raymond Scott, College of Engineering, University of Michigan, who served as assistant technical advisors for the Centro. All photos were taken at the Centro.

Tool crib with tools mounted using nails bent to right angle as hangers. Precision tools are in dustproof cabinet in center. Tool kits are below.



Wooden hangers are used in this tool crib. Master tool check panel at right is described in text. Color-coded cans for greases, liquids at left.



Open panel storage with tools mounted on wall of diesel laboratory. Note injector checking stations on bench which has storage space below.

Open storage is used in the welding shop for equipment, tools, and supplies. Hinged doors can be closed and locked. The bins vary in size.

is assigned to the tool crib for a set period of time and this responsibility is divided equally among the class members over the semester.

The crib should be located near the center of the shop and in some cases can be constructed to serve two or more shops. A doorway must be provided for entrance into the crib *from each shop it serves* so each instructor can readily enter to check the tools at the end of the class period, assist the attendant when a problem arises, or to secure tools as needed.

The dispensing window can either be constructed in the door or as a separate opening. In cases where the upper part of the door is used as the dispensing opening, it is more practical to use the entire opening rather than cut a door in it. It is also desirable to have the shelf for depositing tools large enough to accommodate tools easily and extend on the outside of the door if this does not interfere with student movement. Where the dispensing opening is cut into the wall of the crib, it should be large enough to accommodate the passage of the largest tool or piece of equipment consigned to the crib.

Tools should be arranged, in this type of storage, so the infrequently used are in the least accessible position on the panel. This may be the top, the farthest distance from the dispensing opening, or the bottom of the panel. Heavy tools should be placed where the danger of falling and striking the attendant or damaging other tools is eliminated. The most frequently used tools should be placed so the tool keeper can conveniently reach them and near the dispensing opening.

This type of tool storage most nearly simulates that used in large industries.

2. *The tool cabinet* can be constructed to accommodate light or heavy tools as shown and may be locked when not in use. This type of storage is used where a limited number of tools is needed for the operation of the shop and is especially functional where the shop is specialized in nature and special tools and equipment need to be stored.

Cabinet storage requires the entire class to assume the responsibility for the care and replacement of tools in the cabinet at the end of the class session. In operation, the instructor must check the cabinet at the beginning and end of each class session and especially before the class is dismissed to insure no tools are missing. If desired, the instructor can appoint a student to perform this task, the assignment being for one day or one week so as to enable all students to experience this responsibility. The mechanics of maintaining this as an efficiently functioning unit involves class cooperation and honesty and provides an excellent experience in this respect. Tools in some cases, under this system, must be used on a sharing basis and students must learn to understand and live with the procedure.

3. *The open panel* is used in many home shops and is very adaptable and frequently used in school shops. With this system, security of the tools is maintained through keeping the shop door locked unless the teacher or some responsible person is in the shop.

Where several activities are taught in the shop, a panel can be constructed for each activity and located in the area where the work is to be performed. This procedure works well in the general shop and craft shop. The instructional values in this means of storage are similar to those pointed out for the cabinet type.

4. *The moveable rack* is used where heavy tools need to be stored such as in heavy equipment repair shops. The tools mounted on the rack may be special tools to perform a given job or may be a kit of tools for general heavy work. This system eliminates the carrying of heavy tools to and from the job where a central storage facility is used. It also enables storing the tools close to the work being performed, an important factor where heavy wrenches, wheel pullers, hammers, etc., are needed.

Checking of tools at the end of the class session can be accomplished by the instructor checking each rack at the work station before dismissal of students or by having the racks returned to an assigned area. Note lines painted on floor allocating a given area for each piece of equipment in picture on page 18.

5. *Tool, equipment, and supply storage* is used where storage facilities must provide for materials and equipment as well as tools. This may be of the open type or constructed with doors as shown.

This cabinet has proven very useful in our welding and basic hand-tools shops.

6. Bench tool storage is perhaps one of the oldest methods of tool storage used in school shops. Most frequently found in woodworking shops, the storage may either be in a specially designed drawer in the bench, or in a rack on the top of the bench. Where the drawer storage is used, provision for tools is made through special supports or racks.

In such a storage scheme the instructor or a student assigned to this task checks each bench before the class is dismissed and each student is held responsible for the tools in his bench.

Methods of Mounting Tools Adaptable to Shop

The effectiveness of a tool storage unit depends to some degree on its appearance. A neat, attractive tool crib, panel, or rack has a marked effect on the students' attitude towards tool control. Visitors who enter the shop are invariably interested in seeing the tools, as they indicate to some degree the caliber of instruction being offered. Good tools, if poorly arranged and mounted, do not show up to advantage. It, therefore, behooves administrators and the teacher to see to it that the tools are well arranged and mounted.

The photographs in this article show various methods of mounting tools. These may be classified as follows: (1) screws or nails, (2) screw hooks (90° bend),(3) nail hooks (90° bend), (4) commercial spring clips, (5) wood shelves or supports, (6) perforated fiber panels with commercial hangers, (7) formed iron brackets or supports, (8) sheetmetal formed brackets or supports, (9) tool kit boxes with supports, and (10) tool tote racks.

Actual mounting of tools can be done by students, the instructor, or the maintenance department. In any case, the over-all planning must be done by the instructor. In situations where all of the tools to be mounted are available before the actual mounting is started, the instructor should arrange the tools on a table or other flat surface to get a suitable layout.

Tools should be arranged so they present a balanced appearance on the panel to which they are mounted, that is, one section of the panel should not appear heavily loaded as compared with another section. The distribution should be uniform. This "balanced" effort is important for good appearance. Furthermore, tools should be grouped in accordance with their use. Thus, all brake service tools should occupy one area of the panel, valve tools another, etc. Screwdrivers, punches, drills, pliers, etc., should also be grouped. Appearance and balance are improved by symmetry, by placing large and heavy tools at the bottom of the panel, and by not crowding tools together. The panel should be varnished to present a finished appearance and the tool silhouettes cut out of paper and pasted to the panel. This eliminates the necessity of scraping off painted silhouettes when the position of tools needs to be changed.

Where all of the tools to be mounted are not available when the tool storage unit is being constructed, the problem of arrangement to secure balance and a neat appearance is more difficult. In such cases the instructor will need to visualize what future purchases will be made and make provision for their location and placement on the panel.

Mechanics of Operating a Tool Storage Facility

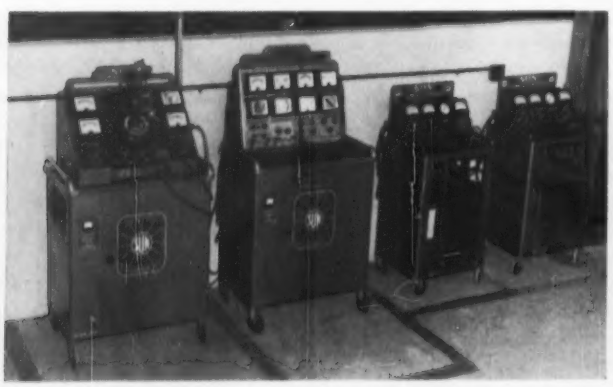
As in the case with other devices used in a shop, the effectiveness of the device, in fact its operation or failure, depends to a large degree on the mechanics of operation. A well designed and constructed tool storage unit can fail if the instructor does not set up the machinery for its proper functioning. Following are items which need consideration for the correct operation of a tool storage facility.

Tool checks.—These may or may not be used to control issuance of tools but, if they are used, there are certain ideas which should be considered in their use. Checks can be numbered consecutively, with a given series of numbers assigned to each class. For example, where several classes use one tool crib, numbers from 1-25 should be used for the first class, 26-50 for the second, etc. Another method is through the use of checks of different shapes or colors. Where the tool cribs serve more than one shop, as well as evening-school classes, different metals, such as brass, copper, and aluminum, can be used to identify groups. When a tool is missing, the check indicates by shape or color the class or shop to which the tool was issued. At the Centro a special set of ten checks is issued to each teacher and to maintenance personnel to enable them to obtain tools from any of the eight tool storage units in the school.

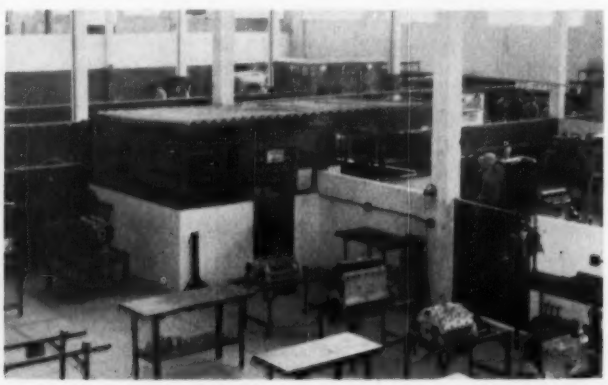
Tool check control.—Perhaps the best method of controlling tool checks is through the issuance, at the beginning of the semester, of five or ten checks on a key ring to each student. The student should make a cash deposit for the checks, the deposit to be returned at the end of the semester if none of the checks have been lost. Issuance of checks can be from the central authority or can be left up to each teacher.

Tool checking procedures.—In operation, the student acquires a tool or set of tools in exchange for one of his checks. The tool keeper places the check in a designated place near the spot from which the tool was removed. On return of the tool or set of tools, in good order, the procedure is reversed and the check returned to its owner. In cases where it is impractical to place the tool check in the location where the tool was stored, or where an item is checked out and no

Movable equipment and tool racks are kept in designated areas by marking floor with lines allotting storage space. This method helps in control.



Tool crib serves two shops, diesel at right and automotive at left. Low walls separate shops. Interior of crib is shown in the pictures on page 16.



provision is made for the check, another procedure is used. In this case the name of the tool or item checked out is written on a round metal-bound tag and this, in turn, placed with the check on top of it on the master tool check panel. When the tool is returned, the tag is placed in a container provided for this purpose, to be erased later, and the check returned to the student. This idea should also be used in situations where a check needs to be placed in a location where it may become lost.

Assignment of students to crib.—The student should be assigned as tool-crib attendant or tool checker for a period of one week. Shorter or longer periods may be used but they do not lend themselves well to this procedure. During his time in the tool crib the student would need to complete the work outlined on the job sheet for this purpose.

Student responsibilities.—These vary with the type of system used. It is the responsibility of the instructor to devise a procedure that will operate in his particular situation and, if one does not work, another should be tried. The procedure established should, of course, place definite responsibilities on the class as a group and also on individuals in the class. If a tool crib is used, the experiences gained come about through the tool-keeper's contact with the students he serves, thus placing very specific responsibilities on him. On the other hand the class must be made to realize, also, that they have certain responsibilities in order to relieve the load on the tool keeper.

Teacher responsibilities. — Naturally the effectiveness of operation and control of a tool storage unit rests with the teacher. It is his responsibility to see that a suitable tool storage unit or units are in his shop. He must teach the students, through daily checking of the crib or panels, that he is serious about the matter. Spasmodic and careless checking by the teacher transmits an air of carelessness to the student which will ultimately destroy the purpose and effectiveness of the unit.

Marking tools for identification.—It is often desirable to mark tools either with the name of the school or name of the shop. This is sometimes done by painting a portion of the tool with an identification color. A more effective method is through the use of an electric pencil which electrically etches the information on the tool.

Identification figure on tool checks.—Where the tool checks are fabricated within the school shop, an identification mark must be placed on them to eliminate the possibility of students fabricating replacement checks when originals are lost. This can be done by having a special punch fabricated with the school initials or a special figure as a "brand" with which each check can be stamped. This mark then makes the check valid. The "brand" should be such that it cannot be copied or reproduced by the students. Checks without this validation mark should not be accepted by the tool keeper and students found possessing illegitimate checks would be immediately reported to the check-issuing authority for investigation.

Color coding supply containers.—In tool cribs where oils, greases, or other such materials are stored, it may be desirable to color-code containers. This will prevent mixing of materials or use of the wrong material on a job.

Reference books in the tool crib.—Where reference books are used in a shop, it is sometimes a good idea to store these in the tool crib where they are checked out like a tool. This places the responsibility for the proper care and return of the book to the tool crib on the student and provides a closer check on books and manuals as compared with the shop bookshelf idea. ★

GENERAL TOOL CRIB PROCEDURES

The Duties of the Tool Keeper:

1. To issue and receive tools, equipment, materials, and books, obtaining a tool check for all items issued.
2. To keep the tool crib clean and orderly at all times.
3. To see that all tools are maintained in working order.
4. To report broken tools to instructor immediately.
5. To keep all items in the tool crib in spaces provided for them.
6. To place checks in the location provided for them.
7. To order materials and supplies before they are depleted.
8. To offer suggestions for the improvement of the tool crib.
9. To keep materials in cans as per Color Code Chart shown below.
10. To report any student who is not cooperative in the administration of the tool-crib procedures.
11. To keep all lubrication guns and oil cans filled with the proper lubricant.
12. To maintain all extension cords in proper safe working order.

Don'ts for the Tool Keeper:

1. Do not accept tools unless clean.
2. Do not accept extension cords unless properly coiled and ready for hanging on support.
3. Do not issue cleaning rags without instructor's permission, or receive dirty rags in exchange.
4. Do not lay checks around where they may be lost. The tool keeper shall be responsible for tool checks lost in the tool crib.
5. Do not drive nails in panels to accommodate tool checks or alter tool crib in any way without instructor's permission.
6. Do not allow students to enter the tool crib without instructor's approval.
7. Do not leave tool crib without securing permission from the instructor.

Color Code Chart:

This color code is the one used in this school shop. Other means of identification may be found in other shops. Its purpose is to avoid mistakes in the handling of these materials.

Material:	Color of Container:
Kerosene	Black
Turpentine	Gray top, Black bottom
Gasoline	Red
Lubricating Oil	Red top, Black bottom
Fibrous Grease	Blue top, Black bottom
Gear Lubricant	Blue
White Lead	Gray top, Red bottom
Chassis Lubricant	Yellow
Small Parts Containers	Yellow top, Black bottom

Sample of sheet which can be posted in tool crib. A lesson sheet giving purpose of assignment, precautions, job outline, and questions for tool keeper should be used for educational benefits.

If you're fortunate enough to be planning a new shop, or remodeling the present one, here are

Helps in Handling Storage Problems

By G. Wesley Ketcham

Consultant in Industrial Arts, State Department of Education, Hartford, Connecticut

IF maximum consideration is to be given to the importance of the educational values of school shop experiences, then the planning of storage facilities for tools, materials, and projects must become an integral part of any physical layout and program organization. Carefully planned storage units have inherent implications for learning activities concerned with safety, conservation, and efficiency which cannot be ignored if a more realistic industrial atmosphere is to prevail. Thus, the industrial-arts instructor or supervisor should expend considerable time in analyzing the storage needs for each specific new shop.

"Consideration should be given to the type of shop program to be offered, and the age, grade level, and potential enrolments to be served." This type of general statement is found in most articles concerned with shop planning and, while it is sound general advice, it is of little value to the architect who is not familiar with the specifics implied.

Where preliminary square footage estimates are desirable the following general *minimums* are suggested for auxiliary storage space for projects and materials:

Elementary-school level (grades 6-8)—
200 to 300 square feet per shop,
Junior-high school level (grades 7-9)—
300 square feet per shop,
Six-year high school (grades 7-12)—
300 to 400 square feet per shop,
Senior-high school (grades 10-12)—300 to 500 square feet per shop.

If, as is the case in many schools today, the shop is to be used for adult classes after regular school hours, then additional and separate storage units should be planned.

Specific information in the form of a detailed "statement of needs" should be prepared and presented to the administration, the building committee, and the architect well in advance of the acceptance of final plans. The storage facilities of many shop programs have been "short-changed" in the preliminary stages because square footages have become "frozen" before adequate thought was given to actual storage needs.

Planning for functional storage units involves some basic considerations which are essential to the effective handling of tools, materials, and projects.

Tool Storage

The trend throughout the country in both industrial and school shop planning seems to indicate a real shift towards decentralization in the interest of efficiency. When tools are localized in areas of use, pupil travel and congestion will be minimized.

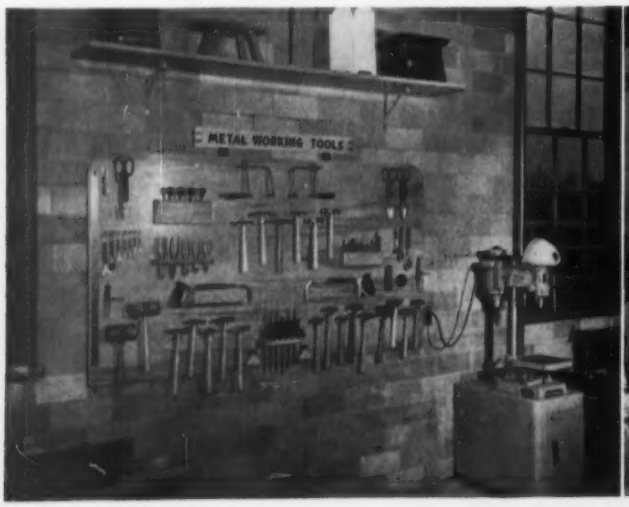
If the localized tool panel or cabinet is combined with a base unit (bench high) designed for operational supplies related to the area to be served, operation will improve through the additional decrease in traffic (*e.g.*, store operational quantities of nails, screws, dowels, sandpaper, etc., in units below the woodworking hand-tool panel or cabinet).

Consider the following when planning tool storage units:

1. Identify the major work areas within a shop where hand tools will be used.

2. Determine the types and numbers of tools necessary for each area.

Following the trend of decentralization of tools for efficiency, the comprehensive general shop at Brockport, N.Y., High School stores metal-working tools in the area where they will be used. (Right) In Perth Amboy, N.J., this tool crib utilizes every bit of space for efficient storage.



3. Select or design a tool panel or cabinet of sufficient size to handle the maximum number of tools needed.

4. An attractively arranged tool panel will encourage good housekeeping habits.

5. Similar tools should be grouped for efficiency, appearance, and ease of checking.

6. Specify panel materials of sufficient size and thickness to handle adequately the tools to be mounted.

7. Hangers, pegs, or hooks should hold tools firmly and permit removal with ease.

8. Design special racks for punches, rules, files, planes, etc.

9. All sharp-edged tools should be so mounted as to protect the pupil from possible injury and the cutting edges from damage.

10. Consider the relative reach of pupils when determining the height of the panel and the tools to be located at the top, *e.g.*, if tools with long handles are hung near the top of the panel with handles down then the height of the panel can generally be increased.

11. Provide stronger racks or shelf units for the heavier pieces, such as planes, portable electric drill, etc.

12. Incorporate a simplified tool checking system through the use of identification markers for each tool holder, *e.g.*, tools removed from the panel can be quickly identified through the use of dotted tool outlines, silhouette cutouts, name plates, or colored tacks. Always use a contrasting color for emphasis.

13. Avoid visible "extra" spaces or hangers for future or additional tools.

14. Where tools are generally used in several locations, consider the need for portable tool dollies or special tool kits, *e.g.*, automotive tool dollies, linoleum block kits, etc.

15. Consider small localized tool panels for specialized areas within the shop, *e.g.*, leather work, radio work, lubrication work, bookbinding, etc.

16. Consider special panels for accessories or tools for specific machines. These should be mounted on the base of the machine or on an adjacent wall or post, *e.g.*, wood-lathe turning tools, calipers, etc.; metal-cutting lathe tool holders, chucks, calipers, etc.; arbor saw extra blades, dado head assembly, etc.

Material Storage

Whenever possible all school shops should include a general supply storage room as well as localized supply centers within the shop. The number and types of supply storage units for any shop should be determined through a careful analysis of the variety and quantity of supplies necessary for its efficient operation in terms of use and numbers of learners to be served.

Consider the following when planning material storage needs:

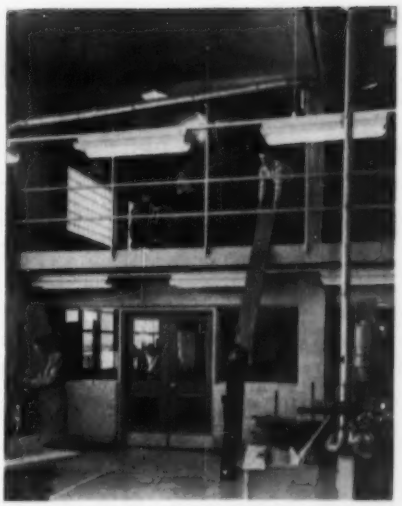
1. Whenever possible a general supply room should have an outside door convenient to a delivery truck unloading platform or ramp. If an outside door to the storage room is not feasible because of over-all building plans, then the storage room should be located as close as possible to the outside delivery door of the shop.

2. Locate the inside passageway of the storage room close to the service machines of the shop generally used to cut lumber and metal to usable size.

3. Whenever possible provide separate supply units for day and evening material storage.

4. If space will permit horizontal storage of lumber, allow sufficient length to handle 16′ pieces. Rack should be fastened to the rear wall and the floor to give added strength. The rack should be so designed as to permit storage of the heavier types of lumber on the floor and bottom supports. The more levels of horizontal support provided, the greater will be the flexibility in ease of handling and separating the various types of lumber.

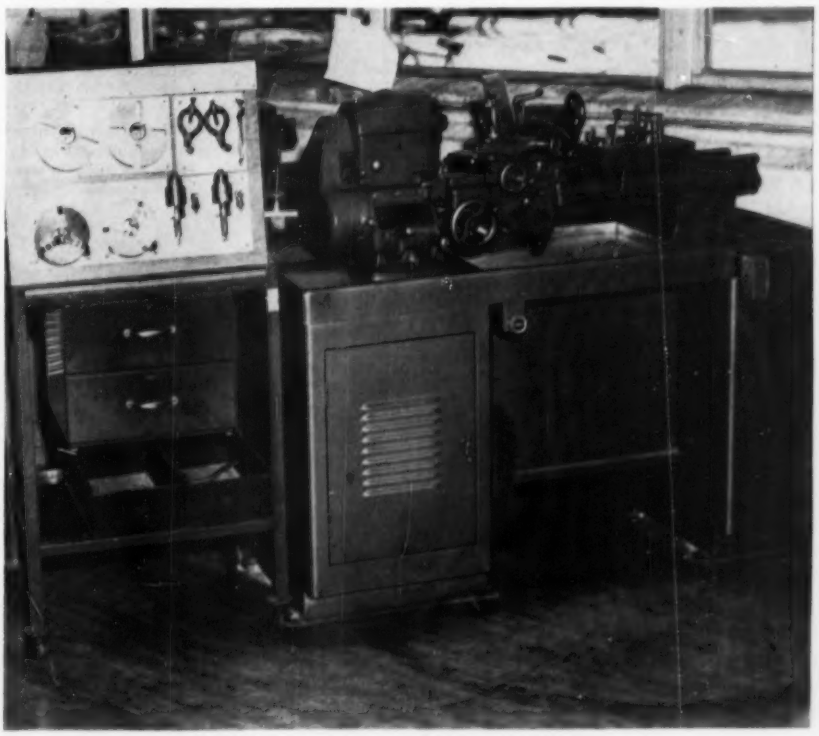
5. Vertical lumber racks will generally take up less space than horizontal lumber racks but ceiling height is a factor which must be considered. When a vertical rack is used, the base should be pitched slightly to prevent boards from falling forward into the room. Slanting the base will also permit the available space behind the rack to be used for the storage of plywood panels.



The finish room is on the left, project storage is on the right, and lumber storage is on the balcony in this shop at Reavis High School, Oak Lawn, Ill. Note the railings for safety.

6. Because of problems of safety and ease of handling, it is sometimes advisable to specify a lower ceiling for the storage room with a deck over the ceiling which will permit a balcony-type

When tools are used in several locations, portable tool dollies minimize congestion and simplify handling. This machine lathe portable tool board is in use at O. L. Smith School, Dearborn, Mich.



A year's supply of steel is stored in a vertical rack at Milton Area Joint Schools, Milton, Pa. Note the slant of the storage rack for safety.

Adjustable shelves give maximum storage space for welding supplies and any item is within reach. Unit is at Harding High School, Warren, Ohio.

storage space above, accessible from the shop by a stairway or ladder. If such a storage balcony is used, it should be equipped with a railing for safety.

7. The amount of plywood now used in school shops justifies the inclusion of plywood storage racks within the general storeroom.

8. Where the storage room has ample space, horizontal racks for metal or wood are sometimes placed in the center of the room to permit accessibility from both sides.

9. Round, flat, and bar metal stock can be stored either horizontally or vertically, according to the space available. Vertical racks of stock size for the storage of sheetmetal as well as round, flat, and bar stock can be used effectively in the general storeroom.

10. Where lumber or metal must be stocked within the shop, the vertical type of rack is frequently selected because of the economy of space.

11. Within the general storeroom, storage facilities for quantity stock supply items should be provided. Because of the variety, quantity, and size of these items a number of different types of storage units should be included. Standard size units of cabinets, adjustable shelving, and bins should be selected according to need and for greater flexibility.

12. Within the shop, operational quantities of the more commonly used supply items should be stored in localized units as close as possible to areas to be served.

13. When planning localized storage units within a shop, consider the need for the following:

a) A short lumber rack below or adjacent to the miter-box saw.

b) Vertical storage racks for lumber and metals in the areas to be served.

c) A wall-type storage rack for bar clamps, C-clamps, and handscrews placed next to a glue or assembly area. Where wall space is limited, a storage unit can be placed below the glue bench.

d) Supply cabinets for nails, screws, sandpaper, etc., below tool panels or adjacent to the panel.

e) Special supply cabinets should be provided for such areas as leather, art, metal, ceramics, bookbinding, silk-screen, electrical.

f) All paint, stain, and other volatile materials should be stored in steel cabinets.

14. The well organized shop will have storage units which can be quickly checked for needed replacement. Many shop programs incorporate a "running inventory" system which insures periodic attention to shortages and at the same time gives pupils an opportunity to assume responsibilities while gaining experiences in good industrial practices.

At Corinth Central School, Corinth, N.Y., angle, rod, and bar steel is racked against a slanting panel for easy selection. Note the strap holders to help keep the bar steel supplies upright.

Project Storage

Failure to provide adequate project storage facilities for any shop is a major cause of confusion, inferior finished projects, and general discouragement. To determine the over-all space needs for the unfinished projects in any shop it is important that consideration be given to the probable types, sizes, and maximum numbers of projects that may be under construction at any one time. As previously mentioned, if adult activities are included as a part of the shop program, then additional and separate storage facilities should be planned.

Consider the following when planning project storage units:

1. Plan for individual storage units in a general storeroom if possible.

2. Avoid multiple-use storage cabinets or lockers whenever possible, *e.g.*, storing of all the projects of all of the pupils in one class is not advisable because of possible damage and loss.

3. Select adjustable types of storage units with depth of between 24″ and 36″.

4. Provide some free storage floor area within the storage room for unfinished but assembled projects which may be too large for regular storage lockers or cubicles.

5. Locate general storage adjacent to work area and permit orderly distribution and return to storage.

(*Continued on page* 134)

Pointers on handling problems of

Storage in the Automotive Shop

By Edward V. Walters and Andrew D. Althouse

Head, Automotive Department, Wilbur Wright Vocational High School, and Assistant Director, Vocational Education, Detroit, Michigan, respectively. Mr. Althouse is also Co-Chairman, Automotive Industry—Vocational Education Conference

EVERY automotive shop teacher is confronted with the problem of storing materials, supplies, tools, and equipment. Thus the factors of safekeeping, accessibility, ease of handling, inventorying, and, in some instances, safety procedures in accordance with local codes must be given due consideration.

Tool Storage

No one method for storing tools is best for all possible conditions. There are many possibilities for tool storage such as individual tool kits, tool toters, tool rooms, or an open-tool or equipment and attachment panel that is portable. Each has its advantages as well as disadvantages. They must be judged in terms of the following functions of proper tool storage: first, a place provided for every tool; second, an opportunity for keeping tools clean, sharp, and usable; third, tools accessible to the one who wishes to use them.

The school-owned tool kit method has been used for many years. In this method the school provides a tray or container in which an assortment of wrenches and other tools are housed with a place provided for each tool. The student then is able, in checking out the kit, to receive an assortment of tools which will be suitable for many jobs.

Early in the student's training, he should be encouraged to build up his own tool kit to show prospective employers. Lockers which can be locked should be provided for the student-owned tool kits. There is one great advantage of the student-owned tool kit—it cuts down the school-owned tool inventory. Also, it serves to make the student more conscious of his responsibilities.

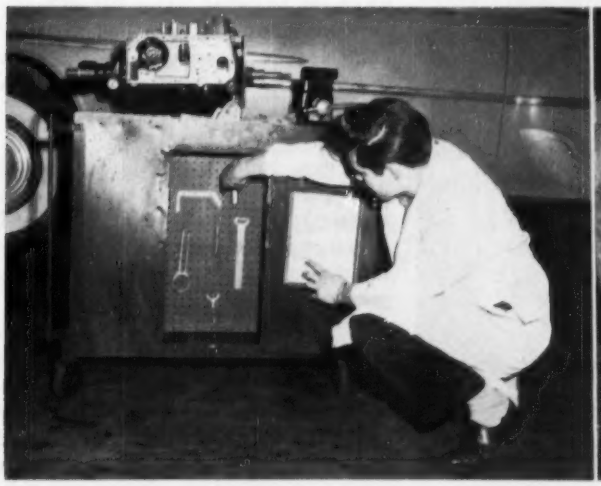
In the more flexible type of shop, such as a long-period automotive service garage class and where finances permit, a portable tool toter or Industrial Roll-Cab as illustrated may be found very useful to store specialized tools for brakes, automatic transmissions, power-steering jobs, etc.

Many schools are finding the use of area tool panels advantageous, especially in the short-period laboratory class. The combination of the tool panel and tool cabinet combines ready accessibility of tools to the immediate vicinity of the work station with the protective feature of safe storage. A cabinet should be arranged so that it may be closed and locked. Also, it should be within the reach of the tool users.

The use of the pegboard type of tool panel, with commercial tool clips, mounted on casters and portable is another method with advantages. It is not only attractive, but provides a systematic placing of tools according to their use as, for example, wheel alignment jobs or valve jobs. Silhouettes for easy return of tools to their particular locations and an illustration or an instruction sheet on the most common uses of each tool should be provided. The outstanding advantage of this method is that it is a valuable teaching aid in tool usage, good housekeeping, and tool care. The disadvantage is that there is less check on tools under this system; in fact there is no adequate means by which to deny anyone access to the panel who enters the shop.

Most automotive-mechanics teachers find that a tool room is necessary for storage of special tools and equipment. The tool crib should be arranged along a wall without outside windows. The crib should be rectangular in shape, not less than 8′ wide and 12′ to 16′ long, and constructed of steel and wire mesh. The open side should have counter-height shelving without doors, and metal screening should completely enclose the remainder of the tool crib. The tool

Portable tool-toter with pegboard panel inside door. Vise and work surface on top add to the usefulness of toter. Note instruction sheet.



Portable open display panel with wheel alignment equipment. Note instruction sheet. Panels are from Wilbur Wright Vocational High School, Detroit.

window should be over the counter. The entrance door should be beside the tool window, but Dutch doors are not recommended.

If the crib is provided with a substantial ceiling structure, storage facilities may be installed over it. In order to save floor space, some communities may wish to use the space over the crib for student lockers and washing facilities.

A work-bench station with air and electrical outlets should be provided in order that the tool-room boy may be given some responsibility in the maintenance of tools. The tool crib must be well lighted.

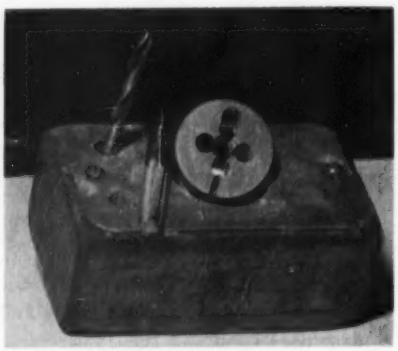
Incidentally, a handy device is to have tap drills, taps, and dies mounted in blocks of wood, as shown in the picture, which can be checked out as an assembly from the tool crib.

Here are three suggested methods for checking tools from the tool room:

1. The instructor issues a perforated tool check card which, on receipt of fee to the bookkeeper, qualifies the student to receive actual tool checks. The bookkeeper retains one-half of the check card and the student the other half. The student uses his assigned checks in the shop tool room in the usual manner. Lost tools are reported to the teacher and are recovered through payment by the person responsible for the loss. Any lost checks are covered by the fee in the bookstore at the end of the semester. This system is best for use in the day-trade classes.

2. For the industrial-arts level, a method can be developed around a self-contained checking system within the tool room itself for serving all classes. The tool-room clerk removes a check from under the assigned individual student number on a tool-check board and places it on the regular tool-board silhouette. This allows the student to use up to five different tools. At the end of the period, tools are returned and checks are replaced in the inventory position. The instructor can readily identify losses or tools not returned. Checks are left so they are ready to be used by the next class.

This neat and well maintained automotive tool crib at the Reavis High School, Oak Lawn, Ill., as seen from tool-dispensing door, has varnished wood panels for tools. Storage cabinet is below.



Assembly of drill, tap, and die with size plainly marked makes issuing from tool crib a simple job.

3. Some teachers may prefer to have the tool-room clerk list the names of tools on a tool-checking form and have students sign for tools removed from the tool room. This is a time-consuming method and is recommended only as a temporary stopgap until a more permanent checking system may be developed.

Storage of Supplies and Parts

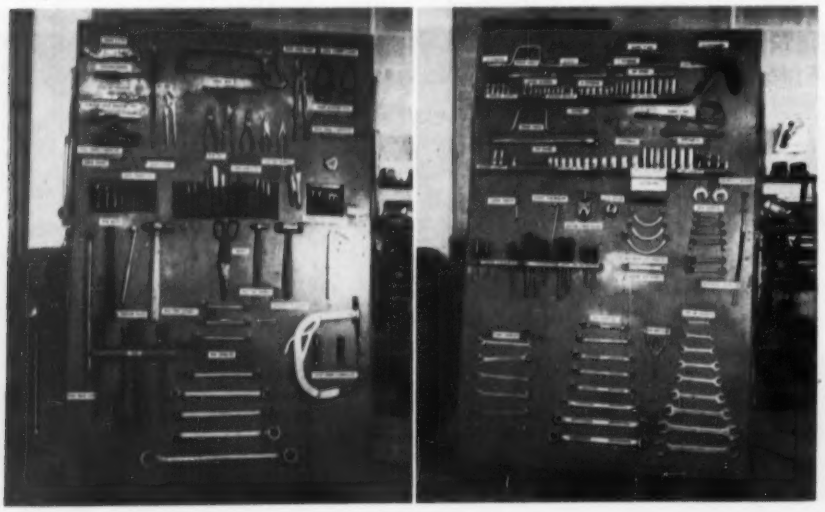
Tube fittings, nuts, bolts, and other fastening and locking devices may be stored in painted metal cans screwed to a wood base and kept in a steel cabinet which can be locked. The metal cans may be alphabetically lettered and the rows numbered to correspond to a chart for identification and location, and at the same time may serve as a continuous inventory.

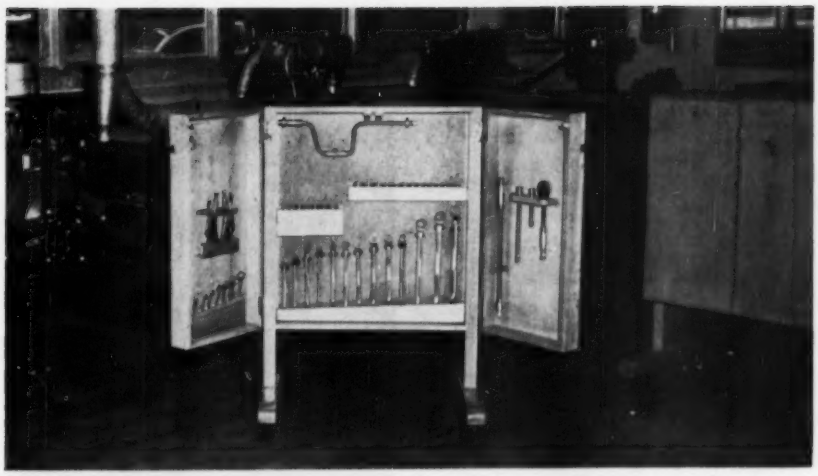
Storage batteries should be marked with painted numerals, cleaned when necessary with bicarbonate of soda, and stored on a rack near the battery charger for convenient recharging, when necessary.

Visual aids, such as films, projectors, charts, and instruction booklets, may also be stored in a steel locked cabinet.

Student-owned protective clothing may be stored in the student's regular hall locker. School-owned coveralls may be

Both sides are shown of an A-shaped tool dolly at the Industrial Arts Department, University of Maryland. All tools are plainly labeled. This unit can be used any place in the shop it is needed.





This portable tool cabinet is easy to move around the shop for all students to use. Both sides contain tools. Note neat appearance when closed at right. From O. L. Smith School, Dearborn, Mich.

MANUFACTURERS' NAME AND PART NO._____

COST_____LIST_____NET_____

MAXIMUM QUAN._____REORDER AT_____

DATE	CHARGE TO R.O.-P.O.-AC-4	INVENTORY ON HAND	PICKED UP BY

Sample inventory card for small replacement parts that helps to keep stocks on hand when needed.

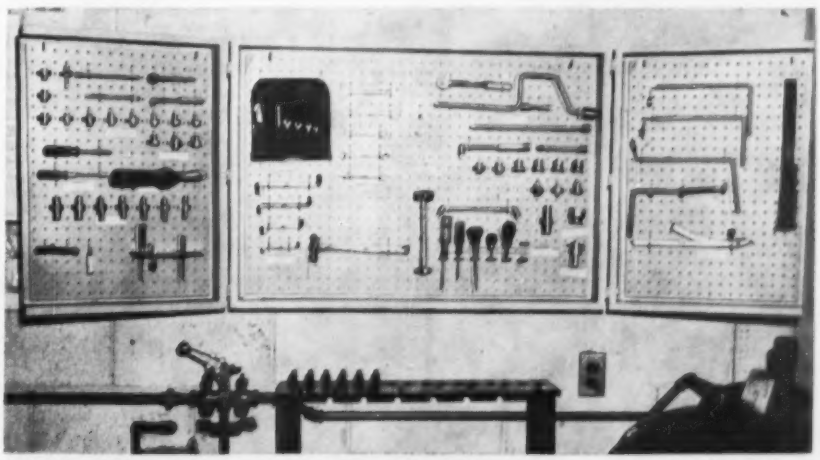
stored in lockers located in the washroom adjacent to the shop.

Storage of Parts Removed from Customer Automobiles.—After disassembling and cleaning, parts removed from cars should be stored in racks with locked doors adjacent to the stall or work station. Parts such as valves, pistons, etc., where the original order must be maintained, should be kept in numbered openings in racks constructed for them. The larger assemblies such as cylinder blocks, rear axles, etc., should be placed in a store room. Open shelves should also be available for small parts which may be tagged.

Stocking of New Small Parts for Replacement.—The stocking of sealed cans of oil and small frequently used parts such as distributor points, condensers, rotors, school rebuilt generators, fuel pumps, etc. (especially for the Big Three), is convenient and eliminates excessive parts chasing. These parts may be stocked in the shop store room, or the school policy may require these items to be disbursed from the bookkeeper's store room. An inventory card helps to keep track of disbursements and charges for these items.

Storage of Gasoline, Oil, and Flammables.—Gasoline should be stored in an underground tank located outside the building. Installation of tank and pump should be made in accordance with the local building codes. Gasoline for laboratory engines should be handled between storage and use in a one-gallon safety container painted red. Engine oil should be kept in clearly labeled portable containers of not more than 30-gallon capacity for convenient storage in the tool or store room. The oil containers should be provided with a hand pump. It is considered good practice to equip the fuel and oil containers with suitable locks for protection. Flammable liquids, such as degreasing solvents, lacquer and thinner, and the like, should be kept in containers and in quantities in accordance with local safety codes. The containers should be used only for the type of flammable liquid marked on the container. The containers should be stored in a locked metal cabinet, preferably in a flammable liquid storage place located outside the shop building.

Provision for Storage of Customer Automobiles. — Frequently overlooked when planning storage facilities is the provision of some off-the-street parking space between the garage entrance and the street. This area should allow parking space for not less than half the capacity of the school service garage. This will provide a place for parking completed jobs which is essential if the shop is small and its floor space is needed for work stations. A fence with locking gate should be put up around the parking space if it is necessary to store cars in the lot overnight. ★



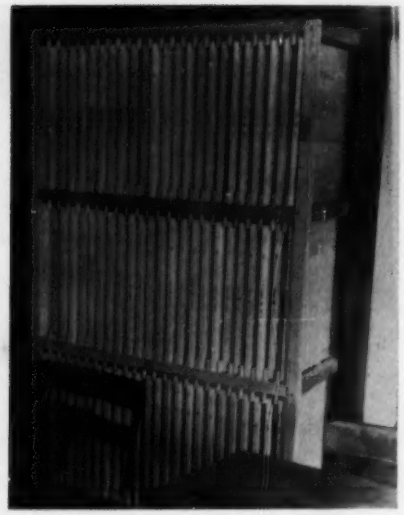
Special ignition and tune-up tool panel is one of 12 similar special panels at Harding High School, Warren, Ohio. Each cabinet contains specialized tools for type of work done in adjacent stalls.

Adaptable ideas for

Storage in the Drawing Area

By R. W. Shackelford

Professor of Industrial Arts, State Teachers College, California, Pennsylvania



Individual drawing boards can be stored in a rack to utilize wall space. This one holds 69.

THE storage facilities in all industrial-arts areas should be planned with the curriculum uppermost in mind; yet planning must be flexible enough for immediate and future change. Each and every school will be somewhat different, and naturally the requirements will vary. However, some basic considerations will apply to most situations.

Careful development of space in advance for storage of equipment and supplies is a necessity, for a jumble of cabinets and shelves without a specific, planned purpose leads to confusion. Inadequate planning relative to storage usually results in piled materials and supplies that defy safekeeping and cannot be found when needed for use. The size, amount or number, frequency of use, nearness to point of use, height, kind of supplies (such as chemicals), and weight of the objects are all very important in planning storage for an efficient and effective drawing area.

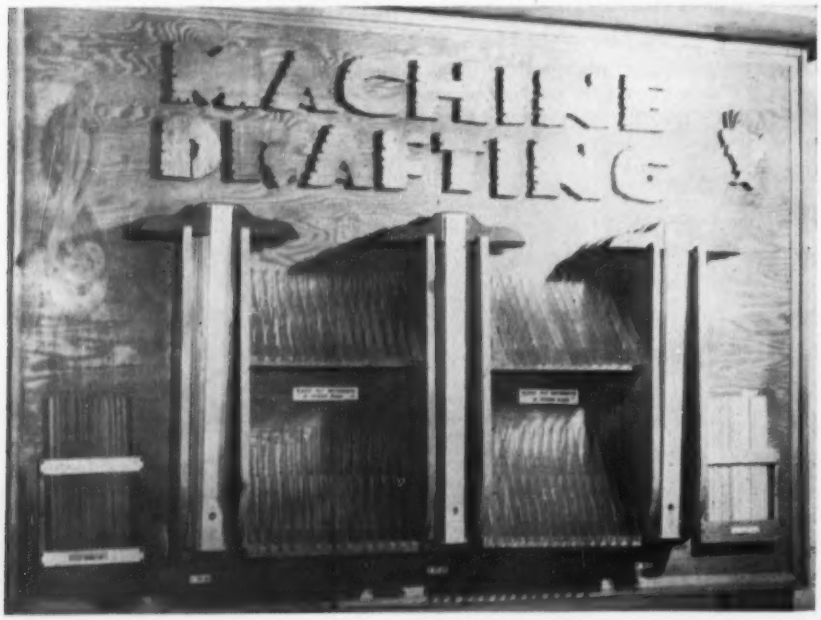
Paper Storage

Paper should be stored flat, if in sheets, and placed in a cabinet with shelves strong enough to hold the weight, and wide enough to permit reams to be piled in such a manner the labels can be read at a glance. Rolled paper should be placed in containers which are labeled.

Smaller sheets, such as small prints or mimeographed or spirit-carbon work, store very well in vertical files, provided an adequate filing system is used. Large prints and tracings are preserved better if kept flat in large drawers with a cloth cover for each drawer. Each drawer is then labeled according to its contents.

Sensitive paper should be stored in light-proof drawers and in a cool place. One picture shows storage of sensitive paper in a drawer near the point of use. Note the drawer has a hasp for a padlock, so the instructor may control paper distribution and limit waste due to excessive light exposure. Rolled sensitive paper should be stored in light-proof containers that are, in turn, placed on a special rack with the cover pointing outward. Data on the type of paper, size, age, and amount left in the container can be written on the container caps.

At Middlesex County Vocational and Technical High School, New Brunswick, N.J., drawing instruments are kept in this wall rack for easy accessibility. T-squares are racked according to number.



Teaching Aids and Project Storage

Deep shelving that is adjustable for height should be provided for storage of large items. Included under this category would be teaching aids for architectural drawing, such as scale models of basements, floor and joist construction, roof framing, as well as students' projects of this nature which are being developed in classes.

Most drawing work can be placed in a relatively small space, so drawers should be included for storage of work being done by each class. The class supervisor can collect, store, and distribute daily work from the class drawer. Best results are obtained if only one person is responsible for this particular task.

An ample opportunity should be provided for students to keep abreast of new developments in the drawing field. Consequently, an attractive display area with current magazines is desirable. Magazines over a year old should be bound and placed in the drawing-room library. Frequent assignments should involve the use of supplementary materials of this nature.

A projector for slides, strip film, or sound film can be moved with ease in and out of storage if it is mounted on a cart with large casters. A small section of the drawing room should be planned for a built-in audio-visual center that includes a speaker, rollaway beaded screen, television set, and radio facil-

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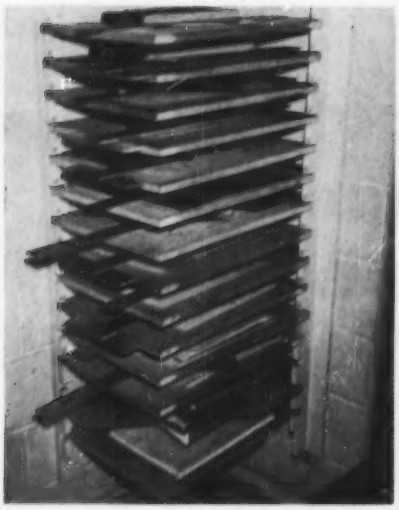
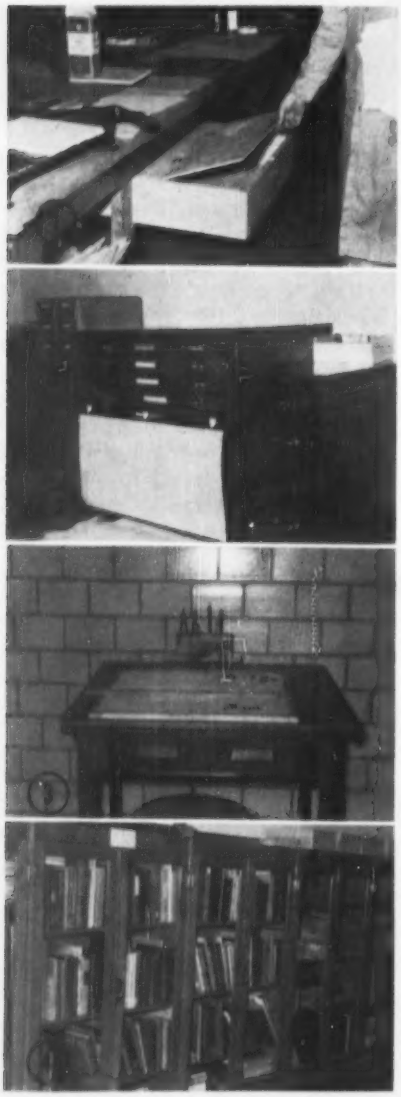


Corner in adjoining closet is utilized for equipment storage at Salisbury, Mo., High School.

The drafting unit part of the power mechanics area at O. L. Smith School, Dearborn, Michigan, has storage of boards, T-squares, drawings, and compasses for six classes. Reference material is below.



(1) Light-proof drawers hold sensitized paper. (2) Large drawings are stored in this commercial cabinet. (3) Instruments may be stored on individual benches in this manner. (4) Reference material should be handy and attractively displayed. All pictures that appear here are from State Teachers College, California, Pa.

ities with storage space below for the projectors, film, and other audio-visual aids.

Small Equipment Storage

Small equipment storage will of necessity be different in each school. High schools should provide drafting machines so students will have an opportunity to learn some industrial techniques. Drafting machines can be stored in their own boxes and placed on shelves provided for the purpose. If the school furnishes drawing boards, instruments, T-squares, and the like, the problem of storage, condition, loss, and replacement of these items seems to mount with the number of students enrolled in the courses. However, if the student furnishes his own or rents the items from the school, he seems to respect and take better care of materials and equipment.

Storage for instruments, drawings, drawing boards, and T-squares can be provided through the purchase of drawing benches with drawers and doors to handle several students' equipment in each bench. If benches of the above nature are not available, then other means must be devised to control these items.

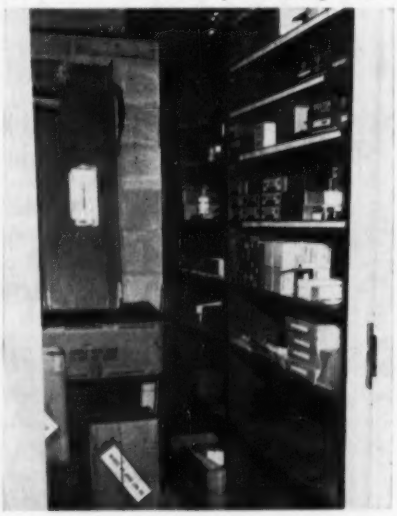
Instrument storage is a problem, for parts are easily lost or mislaid. Again, a well-organized personnel system will aid in checking in instruments at the end of the period and storing them in a cabinet.

Another workable method is to store the instruments in the original box from which the lid has been removed. This box can then be placed in an envelope-type box which has a plastic cover. Instruments can easily be seen, quickly checked for missing parts, and neatly stacked in storage. However, if the preceding method is used, another means must be provided for the storage of T-squares, drawing boards, etc.

A third method is to provide a kit for each student with triangles, pencils, and instruments needed. A kit of this type provides all the equipment necessary, except the drawing board and T-square, and enables the student to begin work immediately. By using the kit, only the instruments needed are purchased, thus a saving for the school may be effected.

(*Continued on page* 108)

Adjustable shelving works efficiently for storing the smaller items necessary in drafting classes.



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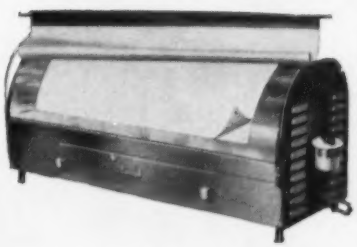

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POST

Some suggestions for handling

Electricity-Electronics Shop Storage

By William A. Kavanaugh

Assistant Professor, Department of Industrial Education, University of Minnesota, Minneapolis

A CONSIDERATION not always given attention in electricity-electronics shop planning is that of adequate and proper storage facilities. Where administrators and teachers have recognized this need there are few sources to which they can go for help. The recent emphasis on the subject in industrial-arts curriculums and the shortage of teachers in this subject area have been the factors limiting information for the electricity shop planner.

Storage problems for an electricity-electronics shop, whether they are related to an area of the comprehensive general shop or the unit shop, are about the same except for the quantity of each kind of storage needed. For efficient teaching and learning in the electrical area, tools and instruments are needed and must be stored.

Projects will be constructed, electrical devices will be serviced, and these must be stored for each pupil for a period of time. Demonstration equipment will be used by the teacher and pupil and these must have a home to go to after use. Materials of many kinds such as tape, solder, resistors, capacitors, and small electrical hardware will always be needed and storage must be provided for these kinds of items.

Where pupil activity devices (wiring boards and peg-board circuit problems) are used, they must be housed in suitable storage facilities. If a shop library with its handbooks, circuit manuals, catalogs, and instruction sheets is a part of the shop, it must have a particular kind of storage.

A consideration of these storage needs makes it obvious that proper and adequate storage for tools, instruments, learning activity materials, and projects cannot be added as an afterthought, but must be an integral part of shop planning. Providing good electric shop storage has its own costs and considerations and must be taken into account the same as the purchase of tool and bench equipment.

Questions Needing Answering

Storage problems in an electric shop are not solved by providing a single hiding place for tools in one cabinet, but rather appear as problems of areas of storage. Some materials or equipment might be stored in benches provided with drawers or lockers, while other things would be better housed in centralized tool cabinets and panels. Protection for projects may require wall lockers or lockers in a corner of the shop.

Where the aims of an electricity-electronics course are broad, following the goals for beginning industrial-arts classes, some storage of electrical materials might best be provided where the work is to be done. Some important questions to keep in mind when planning storage areas are these:

1. How can proper area storage minimize "lost time" consumed in moving about and searching for tools and materials to get working?

2. How can well planned storage minimize "clean-up" time at the end of a class period?

3. How can storage facilities be effective in quickly spotting missing tools and instruments?

4. How can good storage save teacher and pupil time in searching for materials to keep project or learning activity rolling?

The thinking given to these questions in storage planning will in large measure determine the efficiency with which learning can take place in the shop. This is as important for the school shop as for industry, and industrial plants consider this kind of planning most profitable.

For industrial-arts electronics work, two kinds of work surfaces are needed. Benches are needed on which pounding, forming, shearing, and the heavier assembly-disassembly operations may be performed. These benches are needed for fabrication of projects and materials as parts of projects, also in repair and service of many small appliances. If this kind of bench is equipped for storage,

Centralized storage unit containing tools, instruments, and library at the University of Minnesota Industrial Education Department. Steel accordion door encloses cabinet which may be locked.

the stored items must be limited to those not harmed by pounding and jarring. This bench cannot be used for storage of most electrical projects or demonstration equipment. For the comprehensive general shop, the general-duty benches serve this need and therefore cannot be used for project storage.

The other kinds of work surfaces needed for electronics work are benches on which the operations of testing, adjusting, aligning, trouble-shooting, and the more delicate assembly-disassembly may be performed. No pounding or heavy work can be permitted on these benches as projects, meters, and test equipment will be damaged. Storage of projects or demonstration equipment may be included in this bench. The requirements of adequate knee and toe room are important for this bench as it is used in both sitting and standing positions and for this reason stool storage becomes important.

Close-up of tool panel showing white vinyl plastic floor covering used as background. Lines and tool shadows are black vinyl contact plastic. Hinged center panel provides "dead" storage behind.

A Central Cabinet

One solution to the housing of tools, instruments, and working supply of materials is the centralized tool cabinet. The whole cabinet assembly shown here is constructed from five standard steel shelving sections each 36″ by 72″ and 18″ deep. The upper half of the three center sections is devoted only to tool storage. The instrument storage and shop library cases are located to the right and left of the tool sections. Materials are stored in the standard steel drawer plug-in sections below the tool panels. Some of the heavier test oscilloscopes, power supplies, and automotive electrical tools and instruments are stored below the materials drawers. All of the drawer units, shelves, and upright dividers on the shelves are standard pieces available from a number of companies supplying steel shelving. This entire centralized storage assembly can be enclosed by pulling the metal accordion doors to meet in the center. One key locks the whole unit when this is desired.

The tool panels of the centralized tool cabinet are shown in the close-up view. To make a tool panel with beauty as well as function (and tools have beauty for the craftsman), white vinyl plastic floor covering was bonded to ¾″ plywood to make the backboard. This proved to be the lowest cost arrangement to provide a solid backing for tool hangers and at the same time to give a material that would wear and clean easily. In order to use the space behind the tool panels for storage of seldom used items, the center section panel is hinged at the top.

A closer view of the panel shows the aluminum tool-hanger construction and the tool group dividers and shadows. Function and appearance are the two requisites for a tool holder. The tool holder should be heavy enough to hold the tool securely and permit the tool to be held in one position only. With regard to appearance, since the beauty is in the tool itself, the holder should not cover or distort the tool so that it cannot be recognized. Parts of the tool holder that must show should indicate craftsmanship equal to the tool itself.

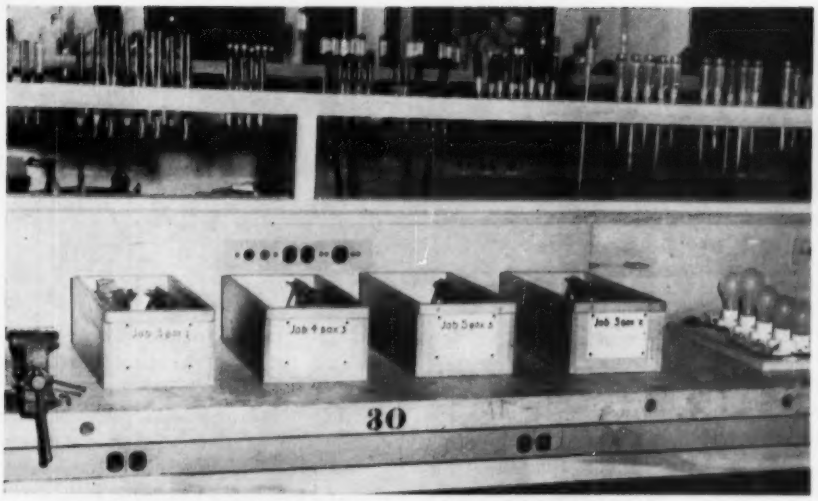
Tool grouping speeds up location of tools. As can be seen in the photograph, this was accomplished by modular patterning in placing tools and through the use of black vinyl plastic for tool-group separation lines. Electricians' plastic tape is inexpensive, wears well, and can be easily replaced when it does wear out. This simple tool line separation permits changing of the blocks quickly when new style tools replace the old ones.

For quickly spotting a missing tool at the end of a class session, a black tool shadow appears in its place to signal its absence. Black contact vinyl plastic, currently available at all variety and department stores, was used for shadows because of its ease of application, good wearing qualities, and low cost. Tool shadows are quickly made by placing the tool on the plastic sheet, tracing tool outline, and cutting out with ordinary scissors. Then remove backing and adhere to the backboard.

The shop library is essential for effi-

Shop library end of storage unit. Drawers below manuals are for instruction sheets and various types of manufacturers' literature and brochures.

Instrument case in unit is made from quick-change shelves and dividers. White vinyl plastic background and shadows are to be added later.



Most frequently used tools in the electricity shop at Parma, Ohio, High School are mounted on a rack above the power raceway. Note various power outlets, boxes on bench containing basic jobs.

ciency in electrical learning activities. When a circuit diagram of a motor or radio is needed, or when a two-minute look at a catalog or tube manual will solve an immediate problem and motivate further activity, reference materials must be quickly available. Storage for manuals, catalogs, and books is provided on the top three shelves of the unit shown here. Drawers below the reference manuals are for individual instruction sheets and manufacturers' literature. The drawer units will accommodate all 8½" x 11" materials and are standard plug-in units available from many companies.

To the right of the tool panels housed in one of the 36" steel sections is the instrument case. As meters and test equipment are precision pieces, they must be given a home worthy of their cost. In this section each meter and piece of test equipment has an individual bin. When completed, shadows behind the meters and identification plates will make return of equipment to its proper place a simple operation. Test leads for instruments are stored in drawers below the tool panels. In assembling this section, shelves were inverted to provide a safety ledge to prevent meters from sliding out and becoming damaged. Dividers on the shelves to make the individual bins are fastened with clips and both dividers and mounting clips are standard equipment with all steel shelving companies.

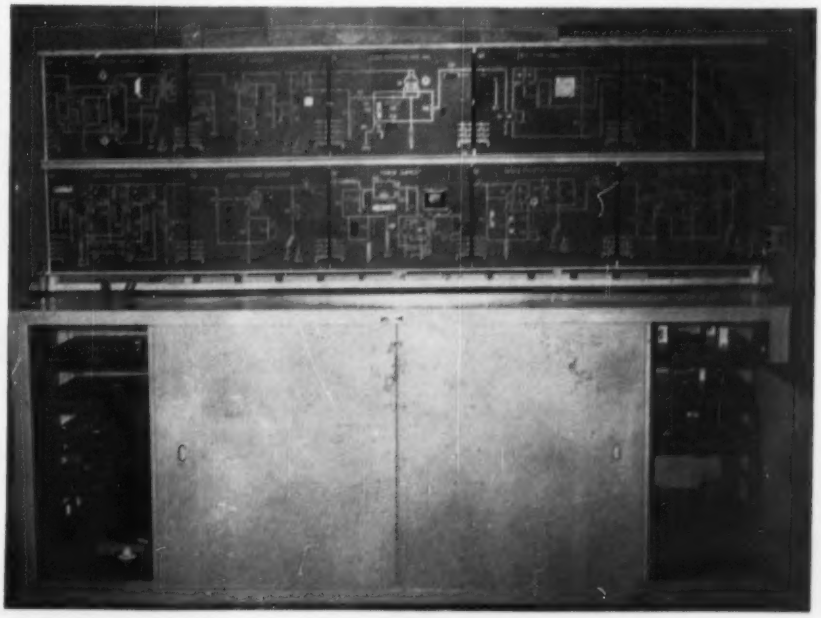
A modern electrical shop without demonstration equipment is not set up for most efficient learning. Demonstration kits, wiring boards, and demonstration panels are now available which can serve the teacher for demonstration, and the pupil as activity and problem-solving boards. Special kinds of storage are needed to care for these devices and materials. Illustrated here is a demonstration unit for electricity, radio, and television with storage included. This is a commercial unit with additional panels added for the beginner in industrial-arts classes. At times when only a single panel or two are in use, blackboard, picture panels, or bulletin-board units are plugged into the demonstration rack.

In this electrical shop, additional storage is provided in the fabrication bench for those items not harmed by pounding, such as electric motors and motor parts, conduit fittings and cables, paint for finishing, etc. Drawers take care of small storage and locker-type cabinets permit motor storage.

The whole basis for devoting planning time to achieve good storage in any electric shop is to have tools, instruments, materials, and demonstration equipment protected and quickly available. In this electronics shop, the instructor has included one device as *the* guide to all storage in the shop. The Wheeldex File shown is a vital tool included in the centralized tool cabinet and lists all items and their location in the shop. In addition to being a location guide, it also is a learning device inasmuch as it lists costs, uses, and inventory information. Industry and service shops would not attempt to operate a shop without one. Should we do less in our industrial-arts electricity-electronics shop? ★

Left: Power supply leads clipped in pairs and numbered for use at corresponding stations are stored on this rack in the tool room at Parma, Ohio, High School electricity shop.

Demonstration equipment panel at University of Minnesota ready for use. Cabinet below panel is used for storage of demonstration and pupil activity panels and wiring boards. Note sliding doors.



Efficient planning helps in

Storage in the General Shop

By Chris H. Groneman

Head, Department of Industrial Education, Texas A & M College, College Station, Texas

THE matter of storage is probably one of the most perplexing aspects of the teaching problem which confronts the neophyte in the teaching field. Storage is often omitted in consideration of shop planning or, even worse, is treated hastily and without sound thought or adequate discussion. In new physical plants, occasionally a teacher or supervisor is fortunate enough to be invited to confer with the planning architect in plotting a new building layout, and the storage situation is then considered as a planned phase of organization.

Methods of storage or handling of tools, materials, and projects vary in accordance with teachers who are advocates of various methods. Perhaps the most important thing to remember is that the problem of efficient, well-organized storage is lessened if adequate provisions and planning are incorporated in the teacher's organization. It would be a relatively simple matter to generate controversy by stating that tool-room storage or tool checking is superior to the open tool panel, or vice versa. There are those who contend that tools should be checked out, such as they are in industry, while those opposing this point of view usually believe an educational attribute of honesty and recognition of proper tools can be achieved only through the open tool panel.

Similar discussion can be created as to the advisability in allowing the student to check out materials from a material center, as opposed to having materials secured for the student by the teacher. The storage of unfinished projects creates a dilemma, especially toward the end of the school semester or year. If pilfering should prevail, as has been my experience as well as others who have participated in teaching and organizational procedures over approximately two decades, a teacher can have in operation many methods of tool, material, and project storage on which he is "sold." This is evidenced in some of the city systems where flexibility is permitted. The individual teacher versus the dictatorial type of supervision, where all facilities and methods must be identical, is an ever-present matter for individual cooperation and adjustment. In the latter case, many teachers lose their initiative and have their originality somewhat curtailed or discouraged, if not completely destroyed.

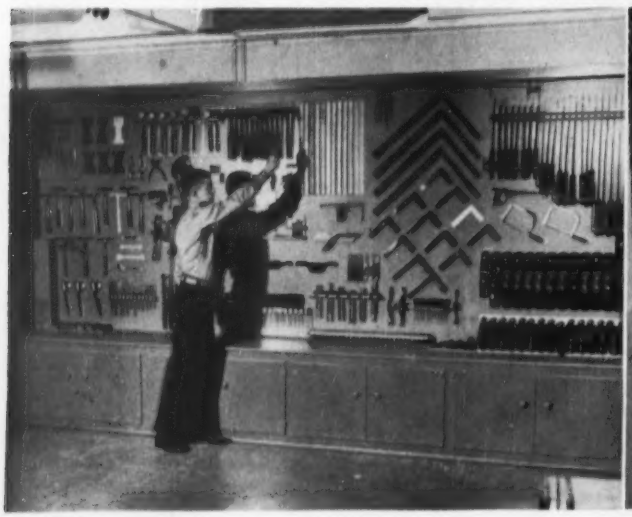
Tool Storage

Junior- and senior-high school youths enjoy learning the names of, and working with, the many hand tools and precision instruments which are used in avocational and industrial pursuits. One seldom enters an industrial laboratory in a school without gaining an impression of respect and interest that the boys and girls have for such tools. Almost always there appears to be a correlation between their type of activity, proper use of tools and equipment, and instructional leadership by the teacher.

When this instructional material deals with planning, proper use of tools and related items generally take care of themselves satisfactorily. An observer has a feeling that the teacher has properly exercised the elements of good judgment, planning, and organization in the instruction and provision of tools and equipment. Studies have been attempted to show the superiority of the tool panel over the tool room, or the opposite side of the question, but, here again, the individual making the study probably was governed, perhaps subconsciously, by past experience or a personal bias.

Some time ago there was a study which appeared to indicate that time was saved by employing the open tool panel method of storage. It was pointed out that much time is wasted by students

An open tool panel gives student and teacher an opportunity to check the return of tools, especially if silhouettes are used to indicate specific placement. (Right) Machine shops often use the toolroom checking system, especially if inventory is quite high, due to the many precision tools.



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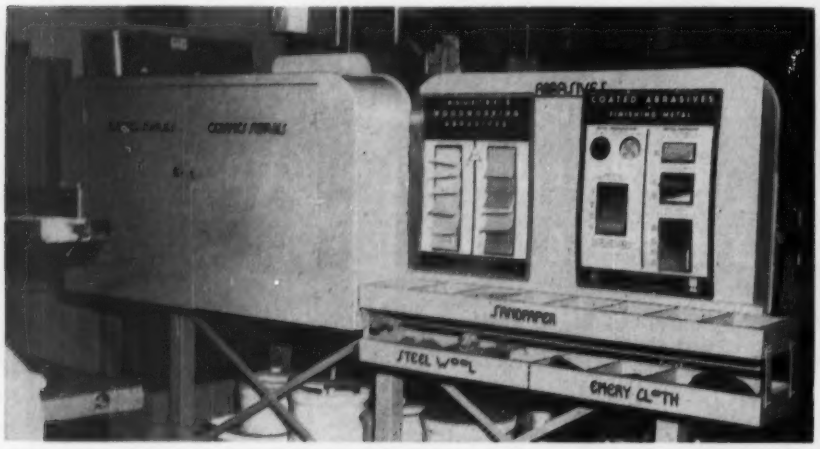
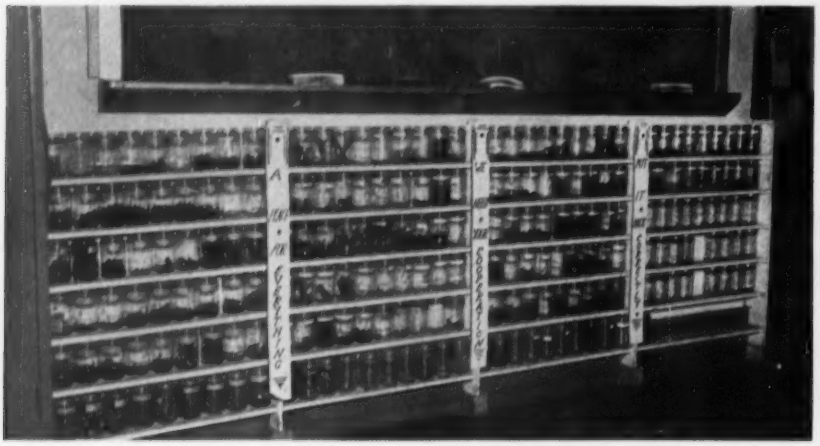
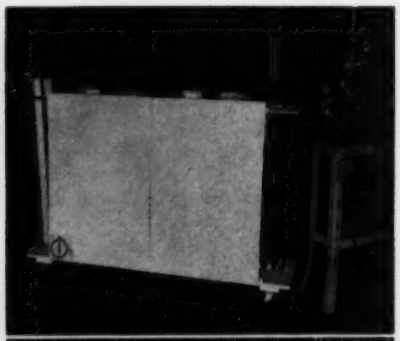
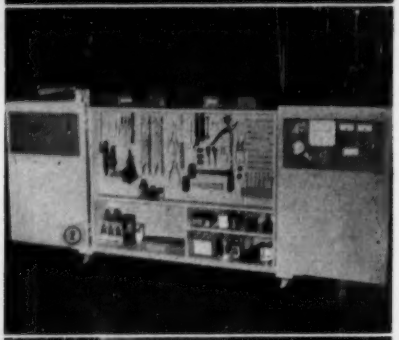
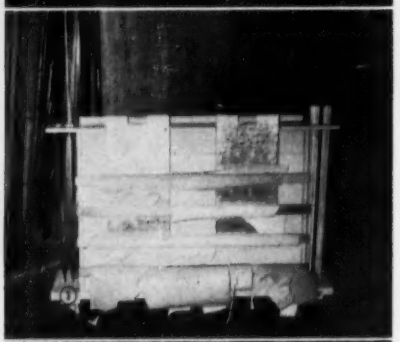


(Above) Supplies for this comprehensive general shop at Red Creek, New York, Central School are handy and well labeled. (Below) Nuts, screws, and bolts are easy to locate at Franklin Roosevelt High School, Hyde Park, New York. Storage of this type is not difficult to maintain.









(1) This portable cabinet holds supplies and tools for a crafts class. (2) When doors are open, tools supplementing the general-shop tools are kept on a silhouetted background. They are chiefly for leather, ceramics, and art metal. (3) The back of the crafts cabinet shows the method of storing leather and plastic sheets. Wood bars holding the leather may be removed for cutting the leather. (4) One of the sheet-metal containers from the back of the cabinet shows how the plastic is stored inside. This cabinet is used in the high school at Salisbury, Mo.

waiting to check out tools and kits, as well as in checking them in at the end of the period. Coupled with this was the objection that a tool-room boy virtually wastes his entire time performing his duties. Those who favor the tool-room method of storage contend that the rotation system of different students in the tool room sharpens their knowledge of those items, and generally teaches them how to maintain tools in top working condition.

Photographs on page 34 depict both methods of storing tools, and, surprisingly enough, the teacher in charge of each laboratory or shop contends that his method is far superior to any other. Both of these instructors are master teachers and employ a high degree of organization in class activity. One concludes, therefore, that the efficiency of either method lies with the attitude, training, and preference of the teacher.

Material Facilities

General-shop teachers have a rather difficult, but challenging, situation in having to provide and work with a variety of industrial materials used in the numerous activities conducted within the general shop. These materials consist of lumber, metal, plastics, leather, and often textiles and other varied, basic materials; all essential to successful and interest-provoking instruction. One of the illustrations shown here is of a lumber supply in which the student clerk operates on a rotation plan, and thereby learns the types of materials, sizes, grades, and methods of allocating supplies to students. Advocates of this plan say that the students enjoy this organizational experience and that they gain much educational value from first-hand knowledge of the materials because of the demands of this system.

Some instructors prefer checking out materials to the student as he needs them, and in this way feel that they can keep up with their inventory. Here again there is no absolute plan. The teacher must have provisions made for material storage and a satisfactory plan for checking out such items by students.

Project Storage

There was a time, not too many years ago, when students had individual drawers or massive work benches with separate lock and key in which to keep unassembled projects and plans. Later there evolved a system of locker storage for each student which was generally against the wall. More recently there seems to be a trend toward individual

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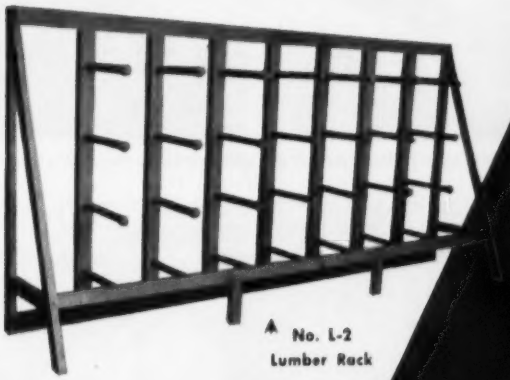

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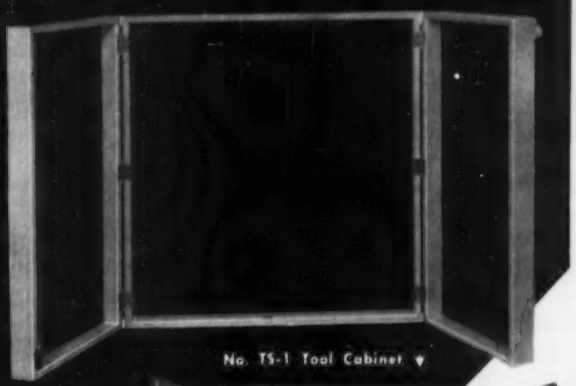

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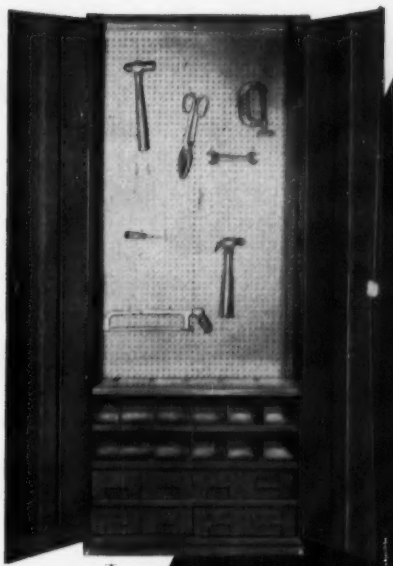
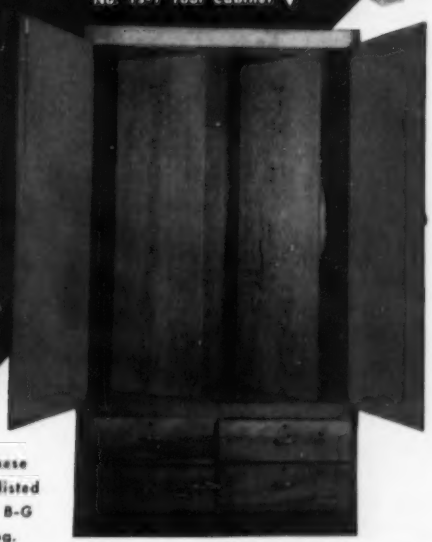
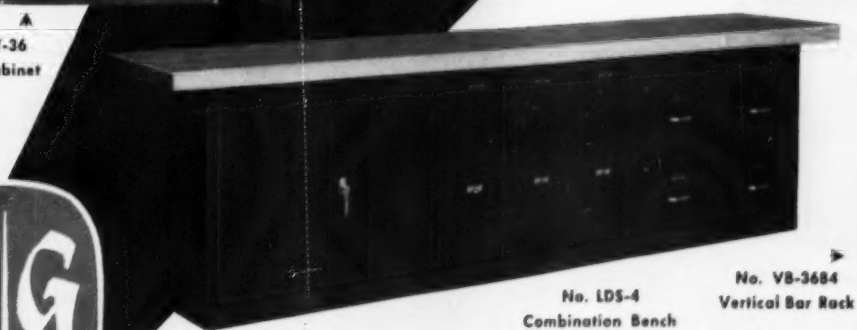


No. T-36 Tool Cabinet





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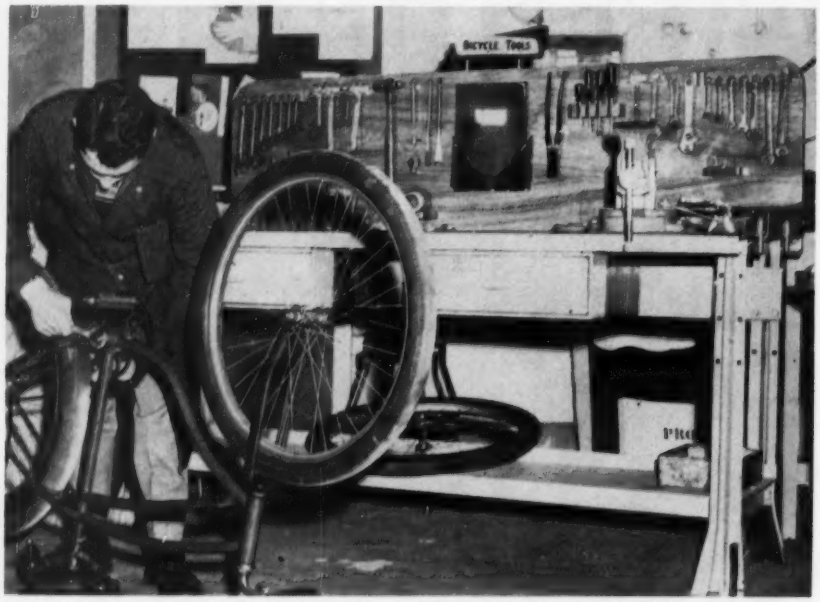
Checking out of materials requires a knowledge of stock, sizes, types, and prices. (Right) Open shelves are efficient for storage of project parts.

class storage compartments which the teacher opens only for that given class.

One of the photographs here shows shelves accessible at all hours of the day. This has proven reasonably successful where the teacher has created a spirit of loyalty, honesty, and cooperation in his students. In other project storage, largely dependent on types of material involved and cost factor, traditional wood and metal projects can be accommodated very conveniently on accessible shelves of individual class compartments, whereas project materials involving leather, plastics, electrical materials, and the more precious metals require special handling and arrangement. The individual teacher must find the most desirable answer and solution for his specific physical situation and class program.

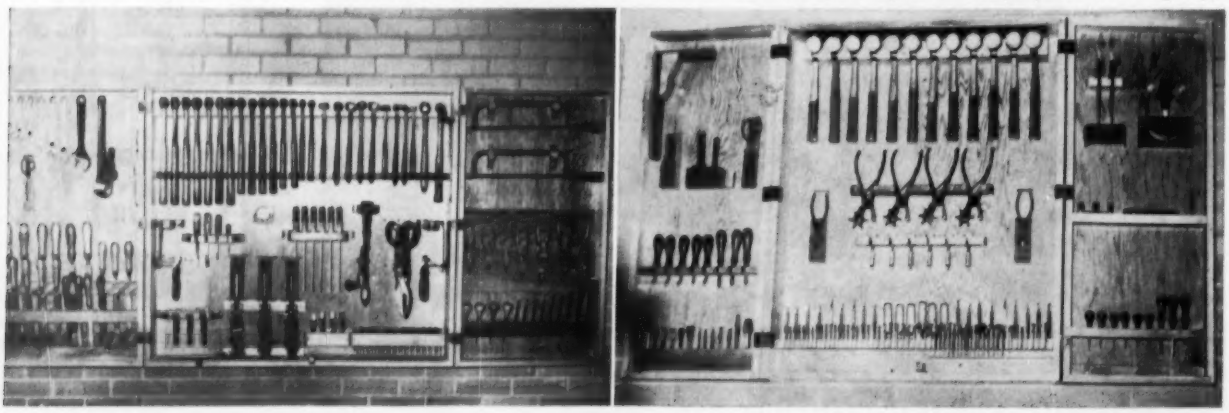
There seems to have been no absolute method proposed in this article to solve the storage problem. It should be kept in mind that methods vary with individual teachers and are as effective as the teacher wishes them to be, depending on his or her organizational ability.

Organization is the key to success in teaching the general-shop type of industrial-arts program. Not only must it apply to storage, but also to methods of teaching, the division of activities, experimentation, and the student-teacher personnel system. In the latter, perhaps most of all, lies the answer to successful class operation. ★



Tools for a bicycle repair shop are kept in an area of the general shop reserved for this purpose.

At Ben Lomond High School, Ogden, Utah, most of the tool holders are color coded with the tools so they can be easily replaced in the right spot.



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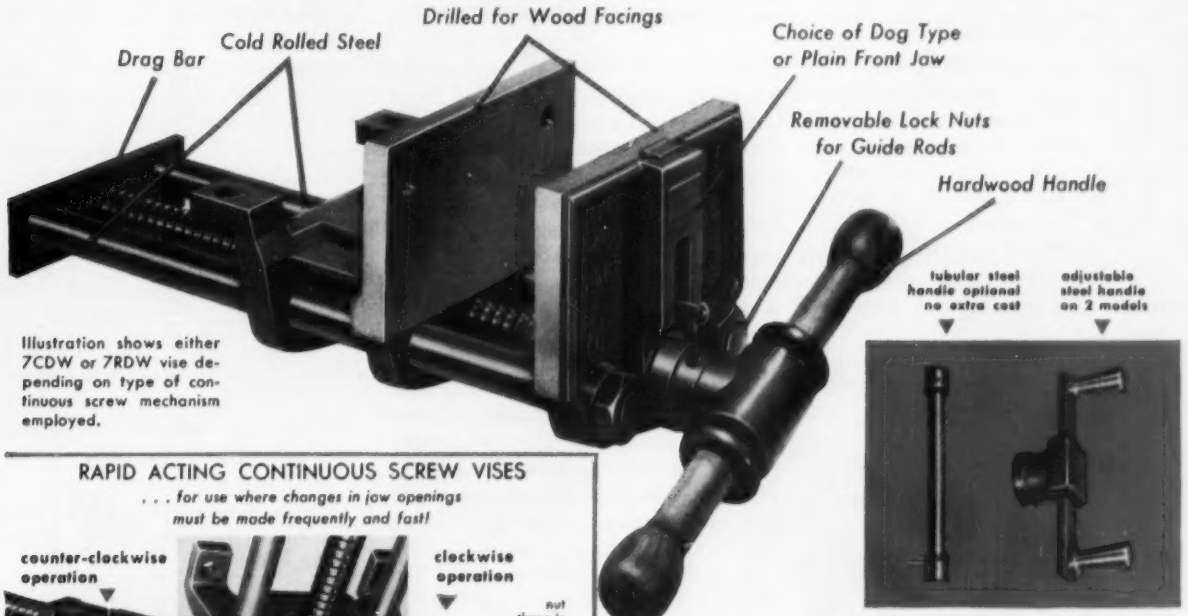
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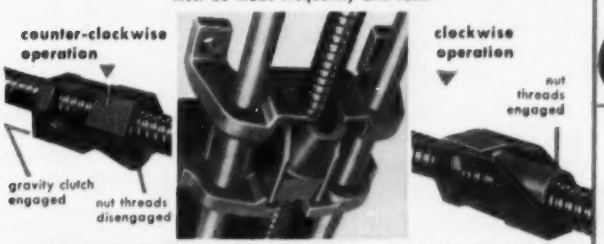

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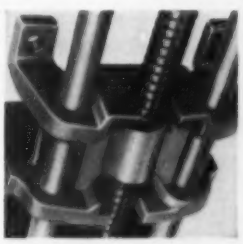

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Suggested practices and principles for

Graphic-Arts Shop Storage

By Dwight W. Nichols

Professor of Industrial Arts and Education, San Francisco, California, State College

EACH graphic-arts activity in the industrial-arts program has its own storage problems. Facilities for the storage of type, inks, and press rollers have been provided by firms specializing in printing equipment. But what can and should be done with tools and supplies for bindery activities, paper cutting, screen-process supplies, materials for making rubber stamps, "pi", stereotype mats, photographic supplies, general and special tools? Following are some suggestions that should be helpful.

The storage of small tools, general supplies, and instructional materials in the graphic-arts laboratory must be a joint teacher-student responsibility. Open tool panels and unlocked storage cabinets help provide an environment for learning through industrial-arts activities. It is assumed that students become trustworthy by being trusted. Likewise, students become conservative by the selection and use of supplies and materials with all the freedom they can manage.

Certain principles may be followed by the graphic-arts teacher in providing storage that is convenient, safe, and visible. Consideration must be given for providing storage for a variety of items other than partially or fully composed masses of individual type characters, spaces, ornaments, etc., as well as type in cases. Bindery supplies, stamping foils, rubber-stamp supplies, paper-making materials, photographic supplies, inks, screen-process supplies, solvents, and embossing (Virkotype) powders are a few of the many items of raw materials that require storage. Finished products, display materials, visual teaching aids (three dimensional), and student work in process deserve due consideration. Machine accessories as well as general and special tools used in the graphic-arts area of the industrial-arts program are seldom stored in any uniform manner. This need not be so.

Wall panel for job sticks and line gages makes checking them an easy matter at the Industrial Arts Department of the University of Maryland.

The teacher and students can make an analysis or listing of items that need to be available in the learning area of the laboratory and can provide adequate storage for each of the items.

Ideas for Storage

An example of planning and execution of the plan is the ink storage and mixing area in the picture at the left. This cabinet of open shelves was designed after consideration of the items to be stored. The list of items included five-gallon cans of solvents, one-quart safety cans, one-pound cans of ink, tubes of ink dryer, extender and varnish, spatulas, funnels, glycerine, plus a plate-glass mixing area. In addition, we wanted to store a supply of ink in tubes. The sides of the open shelves provide a tool-panel area to store special wrenches for platen presses and lubricating oil.

A central panel for storage of small tools, bindery supplies, such as thread, headband, needles, drills, and bone folders, as well as stamping-machine accessories can be wall mounted over a base cabinet with work top as illustrated here. The storage area below provides a dust-free area for a plastic binding unit. The plastic elements are kept in their original shipping containers. A small drawer cabinet will store stamping foils and protect this material from sunlight and dust.

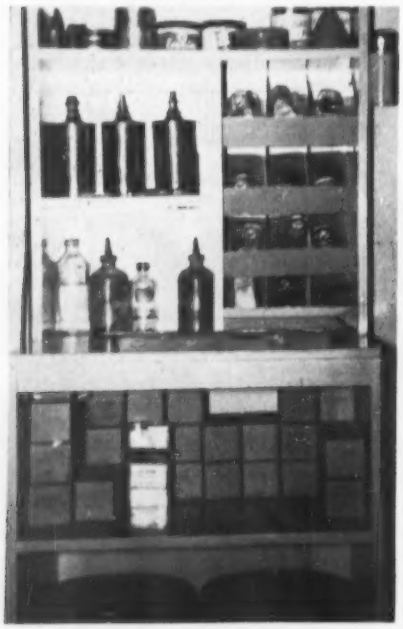
A specially built wooden box about 72 picas long with grooves ranging from 6 to 24 points wide helps to keep odd type characters in order. Damaged type is placed in the hell box.

Screen-process frames can be stored vertically in a cabinet base with work-table top. Frames mounted in patented hinges having a wing-screw fastener are suggested rather than the more popular "school" models.

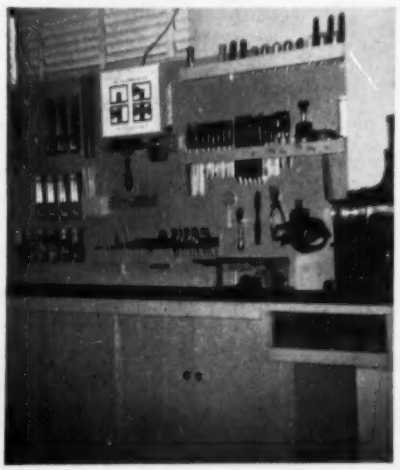
Some uncured rubber will deteriorate when stored in heated areas and direct sunlight. The manufacturer's suggestions should be followed if a quantity is purchased at one time.

Photography supplies can be handled best by individual students. Drawers

An open-shelved cabinet designed to store solvent cans, safety cans, and ink cans and tubes. The sides of the shelf are used for storing oil and the various wrenches used on a platen press.



This central panel is used for storing bindery tools and supplies at San Francisco State College. Plastic binding unit is stored in dust-free space in base cabinet and foil is stored in drawers below the stamping unit shown on the bench.



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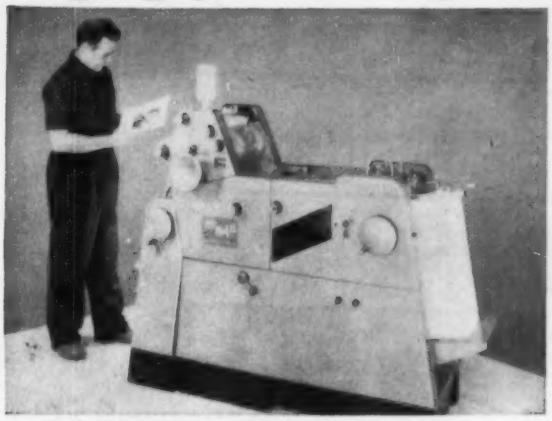

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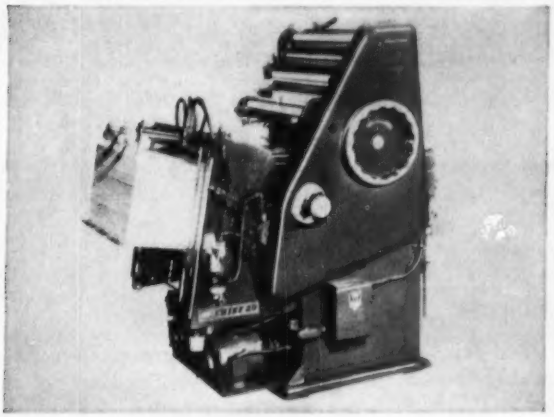

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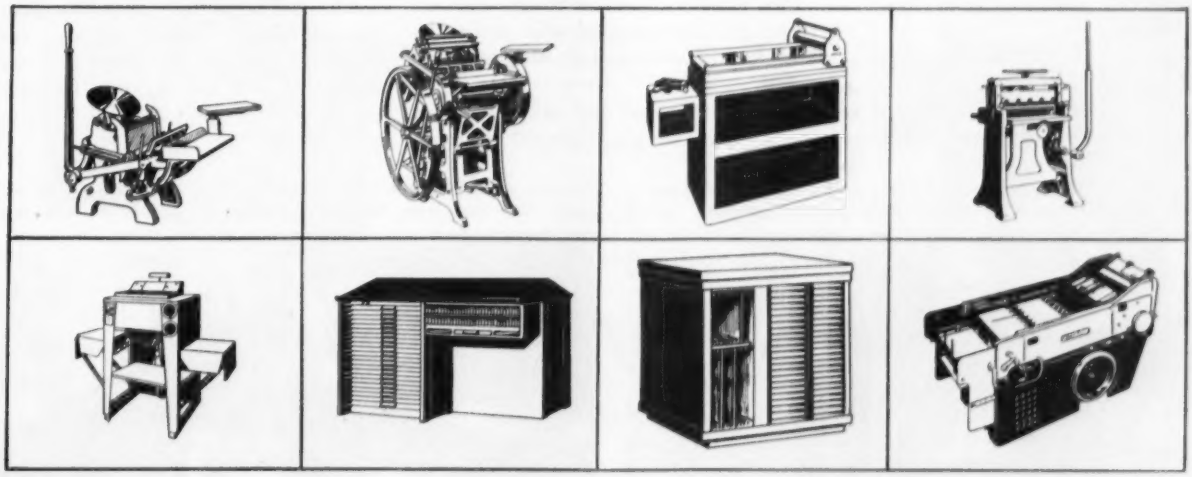

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provided with combination locks and master keyed are a simple solution to a complex problem.

Paper trimmings should be wrapped with a sample of the paper on the outside and the quantity marked in bold figures.

Storage Principles

These principles can be followed to provide safe, visible, and adequate storage in the graphic-arts laboratory:

1. Materials and tools must be stored conveniently close to the instruction area.
2. Materials and tools should be stored for easy and accurate accounting.
3. Inspection for quantity and quality should be made with ease.
4. Items should be stored to prevent loss.
5. Items should be stored to prevent spoilage by sunlight, heat, cold, dampness, and spontaneous combustion.
6. Items should be visible to help reduce duplication, prevent waste, and assist in maintaining adequate supplies.
7. Items should be appropriately marked.
8. Orderliness should govern the arrangement of items on panels, cupboards, racks, bins, shelves, and drawers.
9. An appropriately marked holder should be provided for each item.
10. Students should assume or be assigned the responsibility of checking tools and supplies at the close of each class period and making a report to the teacher.

Instructional facilities which are established as unit work areas can be developed so all tools and materials are convenient for the student. This will eliminate student traffic and the opportunity for students interfering with one another.

This cabinet is for the storage of tools and supplies used in the silk-screen area of a junior-high school graphic-arts shop in Warren, Ohio. Five instructional areas are being taught simultaneously in this shop so this storage unit was developed to help keep things in order.

Students can account for the presence of all tools and supplies rather quickly at the close of the class period when tools and materials are stored conveniently in the instructional area. Supplies not needed immediately should be stored as close to the work area as possible. This practice should eliminate duplication of materials and also assist the teacher in maintaining adequate supplies.

Colored enamel paints provide an appropriate marking material for tools. For example, scissors can be marked in red, black, white, or blue and the same color dot used on the holder. A missing pair can be identified by color. This system assists students to identify the equipment for which they are responsible.

The planning of instructional facilities for graphic-arts activities must not end when machine, benches, and cabinets are located on a floor plan. The planning of adequate storage for tools and supplies, instructional materials, and student projects may become the determining factor of successful learning activities. ★

Paper stock is stored on steel shelving in the graphic-arts shop at the Ecorse, Michigan, High School. Note labels for different papers.

Offset supplies at Ecorse High School are kept in handy place on and under table near press. Note tool panel on the wall at the right rear.

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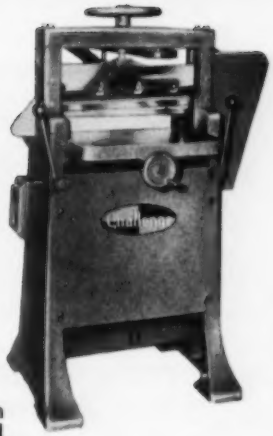

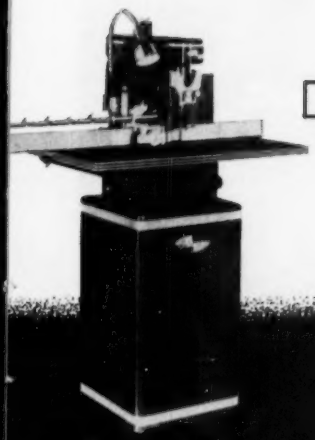

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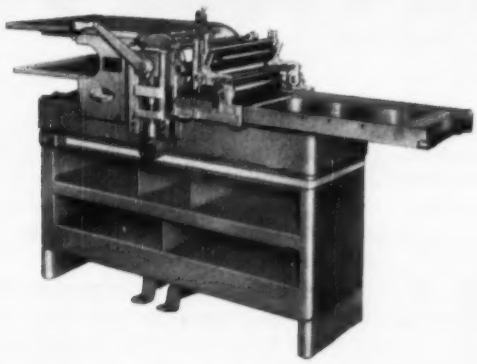

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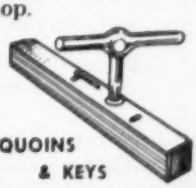

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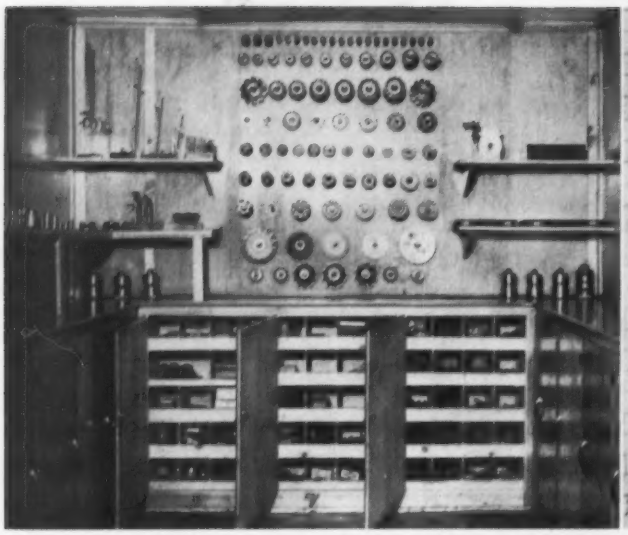

This clean and well lighted tool room is in the McDowell Vocational School, Welch, West Va. Tools are compactly stored. Cabinets below are for small materials. Natural finish of wood walls makes them appear neat.

The Coughlin High School machine shop in Wilkes Barre, Pa., has eight cabinets like this. Sliding panels and drawers underneath can be locked. Formerly a gymnasium, this shop has 4500 square feet of floor space.

Factors to consider when facing

Storage Problems in the School Machine Shop

By Rupert N. Evans

Professor of Industrial Education, University of Illinois, Urbana

THE design of machine-shop storage space requires the solution of a number of problems. As in any other type of problem solving, the first step is the recognition of the problem. If you have difficulty in protecting tools and materials from loss or damage, if material and tools are not immediately at hand when and where you want them, if you have difficulty keeping track of quantities of materials and tools on hand, or if your machine-shop storage does not appear representative of the best industrial storage practice, then you have one or more storage problems.

Perhaps an even greater number of machine-shop teachers recognize that they have one or more storage problems but feel that there is no solution to them. It is possible that this is true, but it is hard to visualize a school shop whose storage facilities could not be improved, even under the most stringent conditions of space and money. It is the purpose of this article to attempt to give you some principles of storage design which may be of assistance to you in working out your problems. Obviously, it would be impractical to attempt to solve your problems for you and, even if this were possible, it is almost certain that storage you have designed yourself will be more satisfactory for you than storage designed by even the best qualified expert.

Purposes of Storage

Four principal purposes are served by adequate storage space in the machine shop:

1. *Protection.*—Obviously one type of storage which would involve adequate protection of one kind would be to have all of your materials and tools locked up in a safe. This might help you to protect yourself against loss. Even more important in the average school shop set-up, however, is protection from damage to personnel and damage to materials. This means then that the materials which we would store inside our safe would need to be segregated from each other so that they could not rub or otherwise damage each other. Moreover, the storage space would have to be designed so that the materials could not topple over, and so that they would not protrude and thus injure personnel going into the safe to get them.

2. *Easy access.*—When viewed in the light of this purpose, our safe does not appear to be so satisfactory as machine-shop storage space. For one thing, it takes a considerable amount of time to open a safe. In addition, the physical effort involved in opening the safe and even in going clear across the shop to the safe to procure materials and tools seems unwarranted.

In order to save time and physical effort, we would probably want the storage space to be located immediately adjacent to the point of use, placed at such a height that no stooping would be required. We do have, however, one factor in common with the desire for protection; the segregation of storage by type and size will help to eliminate not only damage to the material but also

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Each of the ten lathes in the Reavis High School, Oak Lawn, Ill., has an adjoining tool and accessory panel to speed student machine-shop work.

will cut down on the amount of physical effort required to get at various articles which are in storage.

3. *Easy inventory.*—Every shop teacher is faced with the necessity of reordering articles which are in short supply. The storage space should be so designed as to simplify this task. In addition, some schools require that cost records be maintained for such purposes as the sale of articles to students. This means that the storage space should be designed so as to facilitate this task. Every teacher is occasionally faced with the necessity of finding mislaid items. This can be greatly simplified by correct storage procedures.

4. *Representative of industrial storage practice.*—In both industrial-arts and vocational-industrial education, we are faced with the necessity of providing students with the knowledge of good, current industrial procedures. This applies no less to storage than it does to production practices, material usage, and good design.

Anyone who is planning new storage or who is attempting to evaluate his present storage practices should consider each of the above four purposes, and attempt to fulfill them at (5) *minimum expense,* using (6) a *minimum of space.* Every square foot of floor space in your shop is worth $15 or more (if this doesn't sound like much, consider that you could paper the floor of your shop with dollar bills and still be well short of the cost of replacing the space). And storage space is often more expensive than floor space: commercial storage units for small parts will often cost $20 per *cubic* foot.

The evaluation of storage space must remain a subjective matter, at least in the foreseeable future, due to the fact that any design must be based on a compromise. It is obvious, however, that failure to consider one or more of the six criterions will almost certainly detract tremendously from the effectiveness of the solution to the storage problem.

Types of Storage

Most shop teachers will want to use more than one of the following types of storage, since for a particular type of material the type of storage almost certainly will have to be varied in order to meet our criterions.

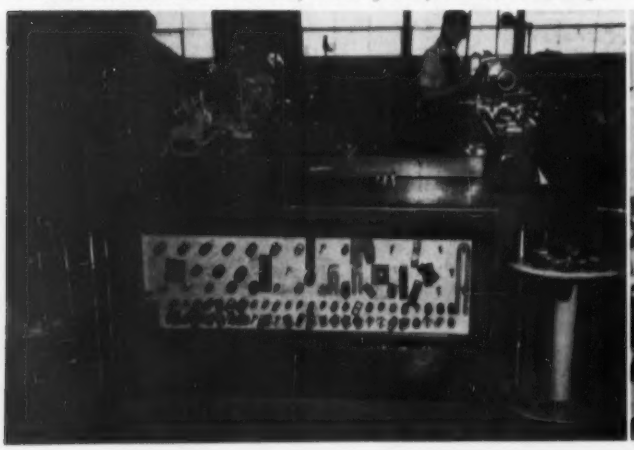
Live storage vs. dead storage.—If a choice has to be made among the various places for storage, it is certainly true that those articles which are needed most frequently should be stored close to the point of usage while those used infrequently can be stored some distance away. "Dead storage" refers to this latter type of space. One of the most frequent difficulties encountered with dead storage is that no one can seem to decide just how dead an article

A check system is used in the tool crib of the Hinsdale, Ill., Township High School. Student places a check opposite his name on class roster.

should be before it should be removed from dead storage. Most of us are familiar with the shop teacher who saves everything, if there is a possibility that he might have a use for it at some time in the unspecified future. Certainly, if the choice is to be made due to space limitations, dead storage should be eliminated first. There seems to be no justification for keeping articles, on the supposition there might *possibly* be a use for them. Rather, storage space should be given to articles according to the *probability* of their use, and those items which are least likely to be used should be discarded first.

Limited vs. full access.—Limited-access space is space which is not available to everyone. Individual student lockers, tool cribs, supply cupboards controlled by the instructor, etc., are all examples of limited-access storage space. The trend in school shop storage design is definitely in the direction of more full-access space, partially because full access normally requires less waste time (that is, it more fully meets our cri-

Milling-machine accessories are stored under this bench in the Harding High School, Warren, Ohio. School designed and made rotary pedestals at end of bench hold arbors for easy checking and prevention of damage.



Vocational students at Harding High School store their tool kits in these lockers. This practice decreases time loss for trips to the tool crib. A time-payment plan for purchasing tools helps students financially.

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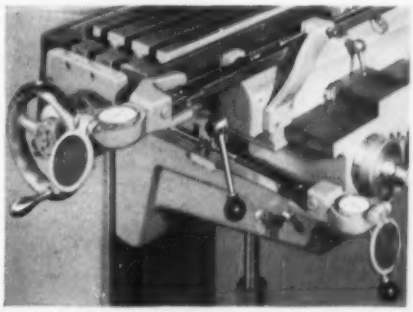

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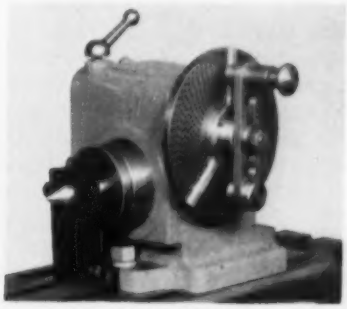

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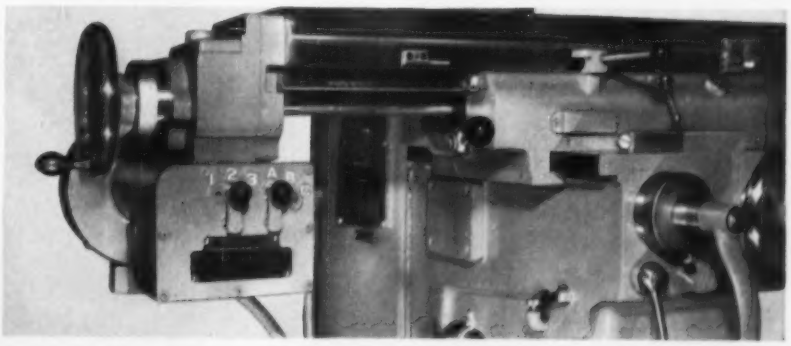

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terion of ease of access) and partly because it is easier to determine whether tools are missing from a tool panel than it is to determine whether they are missing from a set of locked drawers (in other words, it more fully meets our criterion of ease of inventory). Even when tool panels are used, however, it is common for instructors to have certain tool panels which are not open for the elementary classes. Naturally, this involves a segregation of tools according to the time of their usage in the various courses of study. Even more frequently, instructors have some sort of limited-access storage for the handling of supplies which normally require careful supervision such as abrasive cloth, small drills, and expensive, delicate equipment.

Another type of limited-access storage helps to control the supply of surplus small tools. It has long been an axiom of school-shop storage that when tool panels are used they should be kept full. That is, as soon as a tool is broken or is missing it should be replaced with another tool. Otherwise, the board soon has gaps in it which has the dual effect of making inventory difficult, and encouraging students to borrow or mislay tools since it seems to them that a partially stocked tool panel must already have been raided by other students. Consequently, each instructor needs some limited-access storage in which he can keep supplies of tools which are commonly broken or mislaid. From this supply, he can keep his full-access space fully stocked.

Individual vs. common space.—Most storage for student projects involves some type of a decision about the individual or common storage space. Many school shops attempt to solve this problem by providing individual storage space for small projects and some type of common storage space for larger projects which are impractical to store otherwise. Obviously, most tool storage and material storage is common storage. The old practice of providing each student with a kit of tools, for which he is individually responsible and which is stored in an individual space, has largely been discontinued due to the excessive cost to the school district. One important exception to this remains widespread, however. In many vocational classes and some industrial-arts classes, students are encouraged to buy or make a set of tools which they will take away from the shop at the end of the course. Naturally, individual storage space should be provided for these tools. Very often this individual storage can be taken care of by individual, student-owned tool boxes.

Fixed vs. flexible design.—All storage space must be flexible to a certain extent, but there has been greater emphasis on flexibility of design with the introduction of peg board and other similar modular pre-punched boards. School-shop experience with the various types of hangers which are supplied with peg-board panels has generally resulted in the substitution of somewhat more permanent type mountings. As one shop teacher expressed it, "These hangers which they supply may be all right for tool displays in a hardware store, and they are certainly acceptable for individual home workshops, but they will not stand the abuse our students give them." A possible compromise on flexible design is the use of peg board with tool and material hangers fastened on with machine screws. This necessitates some method of removal of the board so that the screws can be changed as needed.

Principles of Storage Design

1. Plan space to fit each item to be stored (since items to be stored probably will change, space should be flexible).

2. Store articles as close as possible to the point of use. Less frequently used articles can be stored further from the point of use than items which are used regularly.

3. Segregate items to be stored by type and arrange them according to size.

4. Identify the space where each piece belongs by a name tag, giving the correct name and size or other designation of the article to be stored. (It is probable that a considerable amount of learning occurs when students are required to ask for a tool by its proper size and name at a tool crib. When tool panels are used, the least we can do is to make certain that students begin to associate the tool with its proper name and other description.) Silhouettes may aid in inventory of certain types of articles.

5. Provide the proper environment for the article to be stored. Obviously, a damp place is not a good spot for abrasive cloth, but an excessively dry, hot spot would not be much better.

6. Use waste space wherever possible for storage (under benches, under windows, jogs in the wall, etc.).

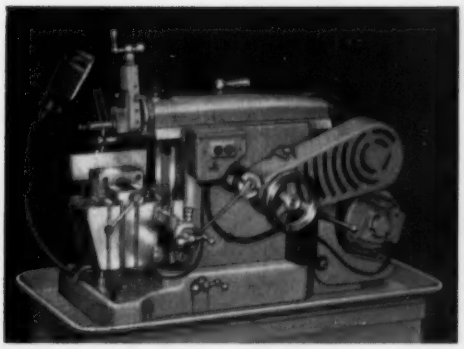
Only the teacher who has had experience with working in a shop which had adequate, well designed storage space can begin to appreciate the importance of such space to increased efficiency of operation of the shop. The teacher who has had experience with this type of organization and who then moves into a shop which is not well organized will make amazing efforts to get the type of storage to which he has become accustomed. On the other hand, the teacher who has been accustomed to little organization of his storage facilities is apt to regard this as a normal part of the shop operation and can see little necessity for efforts to improve the situation.

Both horizontal and vertical storage of materials is used at the Middlesex County Vocational and Technical High School in Perth Amboy, N.J.

Properly Designed Storage Is Not Enough

There appears to be a continuing trend away from a reliance on doors and locks behind which all tools, materials, and projects are stored. As has previously been noted, one reason for this trend is the need for ease of access and ease of inventory. But another reason for the trend away from having everything locked up is that it may not even serve as protection from loss. One machine-shop teacher who had lost a few tools found this out to his sorrow. He carefully locked up every tool in the shop and carried the keys on his person, announcing to the students that he would stop these "thefts" one way or another. When the disappearances continued, he instituted a policy of searching each student before he left the classroom. Within two weeks, there was not a small tool of any description left in the shop.

Apparently, the best protection from loss is provided by well designed storage planned for convenience *plus* a personnel policy that emphasizes student responsibility and care of equipment. It seems reasonable, moreover, to assume that well designed storage and an enlightened pupil personnel policy reinforce each other. ★



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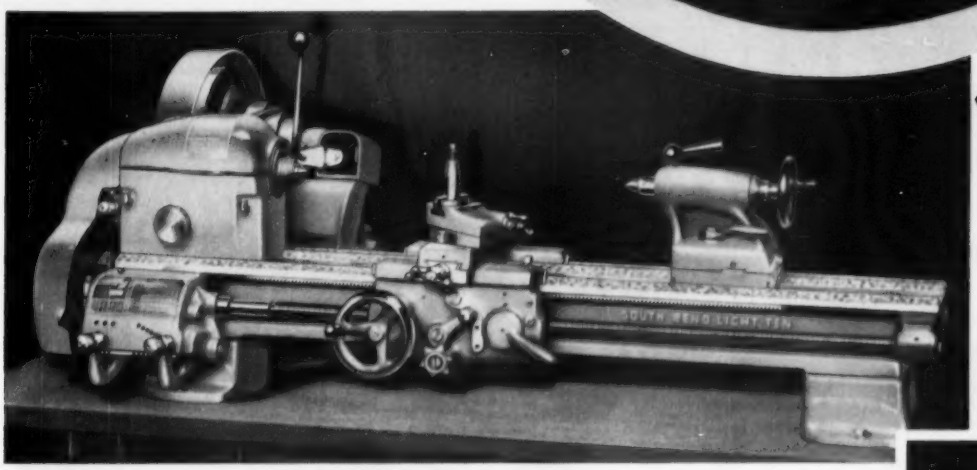

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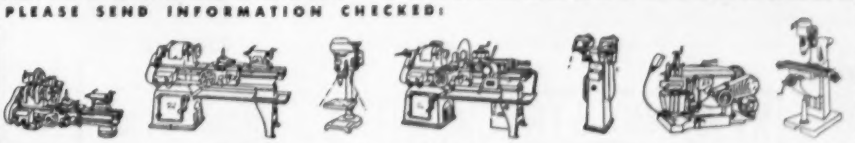

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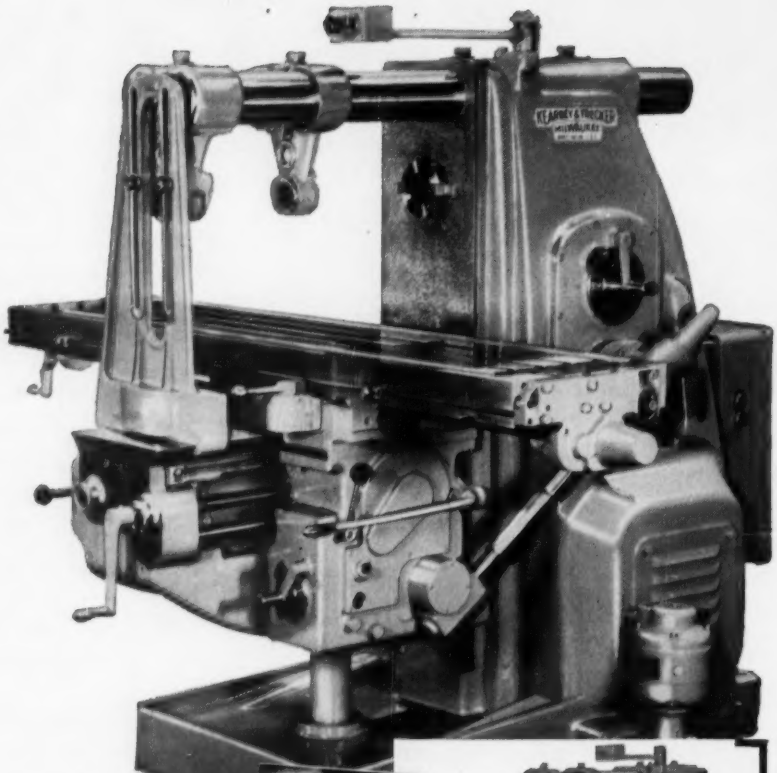

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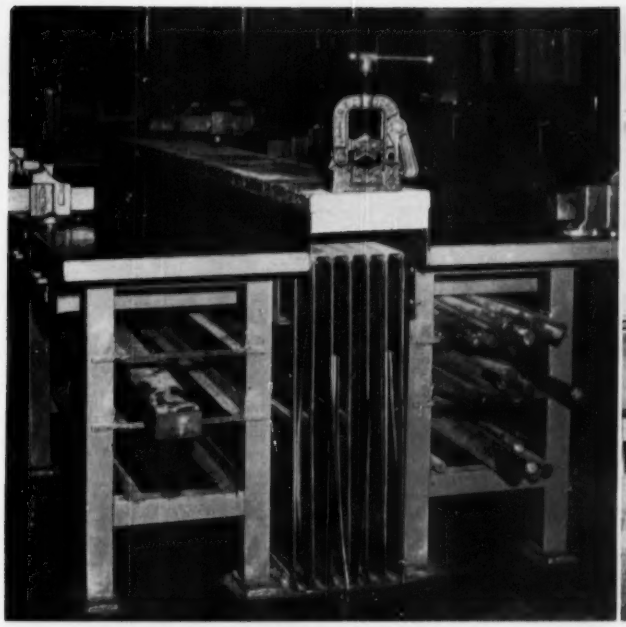
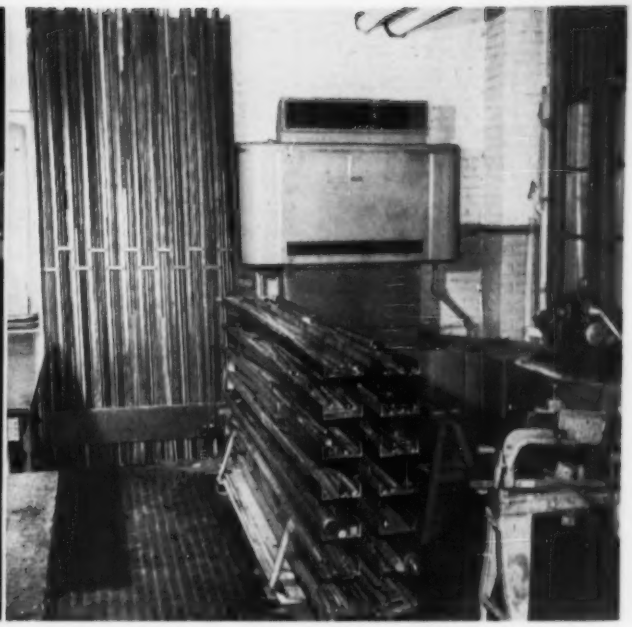




These two views of the Beacon, N.Y., High School shop show both horizontal and vertical storage arrangements for rods, bars, and flat stock. Note on the left how space between benches has been utilized for flat stock, while on the right small pieces are stored in horizontal troughs.

Helpful ideas on

Solving the Storage Problem in the Metalworking Shop

Russell H. Anderson

Head, Industrial-Arts Department, Torrington, Conn., High School

DELIVERY of some bulky supply item to the metalworking shop, which the truckers leave in the middle of an aisle just before a class is to convene, finds most of us guilty of seeking the temporary expedient by leaning the item in the corner or putting it on top of a cabinet or shoving it under a bench.

While we sympathize with the harrassed instructor when this kind of thing happens and sometimes he falls into a happy storage arrangement with a last-minute improvisation, the *real answer* is carefully planned storage facilities whether the metal shop be old or new. Most of us are not satisfied completely with our present arrangements and are seeking improvements or hope to find as ideal a solution as possible when planning a new shop layout. No hard-and-fast rules can be given as each teacher's situation varies, but in the following paragraphs are listed a variety of solutions to the storage problem which should be of help.

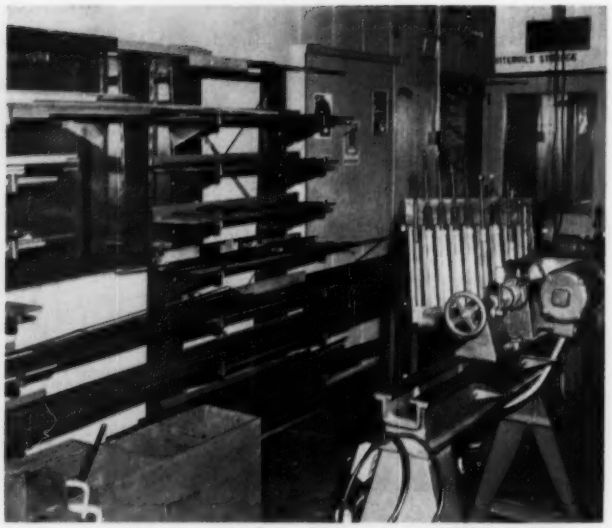
Limited budgets often relegate storage facilities to the end of the list in purchasable facilities. Tools and machines come first, as these can rarely be built in the shop, so shelving, drawers, racks, and cabinets often are provided, if at all, as an afterthought by architects and school planners. Efficiency in instruction requires that careful consideration be given to storage facilities. The following material is subdivided into metal-shop problem areas that need attention so that a smooth-running shop can be achieved.

Bulk Materials

The largest general metal items which consume the major part of the available storage space are the large sheets of metal and the long bars of flat or round stock. In any quantity, these demand a permanent spot with a strong means of support. Ideally they should be placed where they can be handled the easiest and take up the least space.

The merits of the vertical versus the horizontal rack have long been discussed, with the vertical rack winning advocates in recent years. Each has its advantages and problems. The vertical rack must be carefully planned to avoid accident when heavy stock is pulled out. In a shop having limited wall area, horizontal storage under benches and low window sills is usually most sensible. Overhead horizontal storage should be ruled out in nearly every case because of the danger from falling stock and the need for climbing. Horizontal storage of bar and flat stock under benches against a wall is not space-consuming, but is often the

Flat storage is used at the Pittsburg, Calif., Senior High School in a recessed area. Trays like these should be built so that they will slide out in order to retrieve small pieces that get shoved to back of storage space.



Wall rack used at O. L. Smith School, Dearborn, Mich., for handling rods, strips, and pipe. Scrap metal is kept in box below rack. Note the portable rack near metal-spinning lathe for holding various tools and lathe parts.

cause of sorting difficulties. The use of separate racks for each variety of stock is the ideal plan, but often is impossible because of space limitations. One type of cast-iron support has an extended foot, a heavy back column, and extended arms and top rest which make it a handy arrangement.

Storage under free-standing benches is a good solution if care is taken to prevent the stray bar from extending beyond the end of the bench to trip the unwary. Blocks at the end of the bench will help prevent accidents as they keep the stock from protruding. Enclosing a rack, except at the end, and withdrawing bar stock from the end is to be avoided if possible. The trouble in removing short pieces shoved far in on the rack makes the disadvantage of such an arrangement obvious. Side access is safer as a single student can handle the stock from the balance point or two students can each handle an end of longer pieces. Commercial bar-storage racks similar to industrial storage facilities are excellent for use in separate storage rooms but are space consuming within the shop unless it is large. Long lengths can be sawed in a separate room and short lengths kept in the shop ready for use.

It is not always convenient or possible to cut large flat sheets of black iron and galvanized stock into easily stored and handled lengths. Where it can be done, the typical sheetmetal bench with several flat shelves for storage beneath the work surface seems to be the best solution. Some suppliers will cut sheet stock to specified size for delivery if requested and the number of cuts does not require too much time. Storage on edge makes for the easiest handling of large sheets. Sorting is difficult if they are laid flat on top of each other. One answer is to fasten securely to the floor several vertical pipes or rods close together in two rows so the sheets can be slid between them. Each sheet may then be flipped easily by the top and any one sheet may be withdrawn readily from the end. Such a rack fits well along a wall in a storeroom.

Smaller pieces of more expensive metals should be kept readily available but where they can be directly supervised. If very expensive materials such as nickel silver are stored, they should be marked as such and kept under lock and key or at least in an enclosed cabinet. This is to prevent accidental cutting for inappropriate projects rather than to prevent theft. More than one piece of fine metal has been partially destroyed because it was accidentally put into the general supply and cut by a beginnner who had not yet learned to tell the difference between various kinds of metals.

If a cabinet is built in the shop, it can be made with sliding shelves so materials may be removed from the rear of the shelf with ease. This makes it possible to have deeper shelves which may be put close together to conserve space.

Small Supplies

Small supplies present a completely different storage problem. A beginning teacher in the metal shop usually grossly underestimates his needs for bins, drawers, or similar storage spaces. Room for a few boxes of bolts and rivets seems to cover the requirements. Shortly, the

Oxygen and acetylene tanks are stored in a separate building with light walls and ceiling as a blow-out precaution at the Racine, Wis., Vocational and Adult School. Note fire door.

Individual tool panels for each welding station hook over booth partition for easy access at Harding High School, Warren, O., welding shop.

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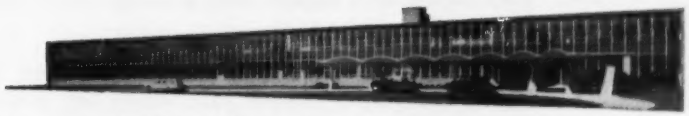

(architects: MacConnell & Walker, Apponaug, R. I.)

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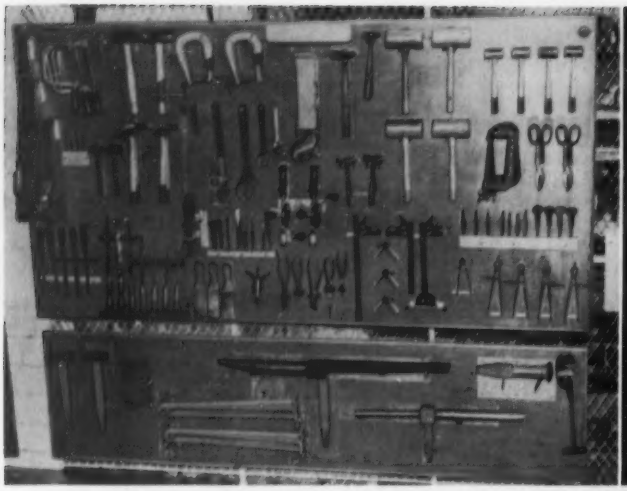
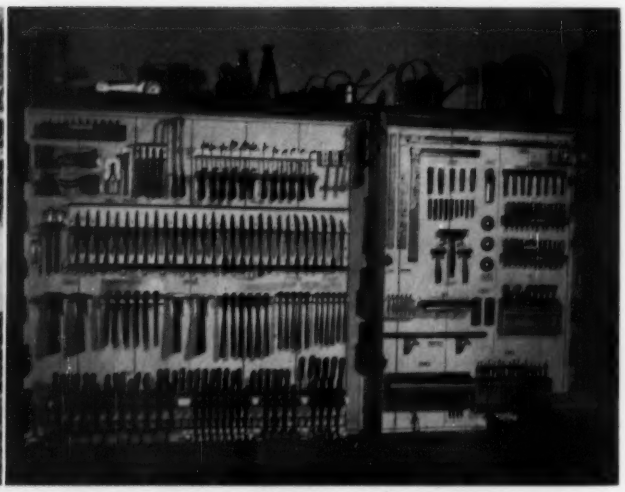


Main tool panel in the O. L. Smith School, Dearborn, Mich., metal shop. It contains 80 percent of hand tools used. Heavier tools are at bottom.



Open tool panel in a Baltimore, Md., school has white background so tools stand out with labels for each. Note guards for sharp-pointed tools.

variety of projects and advanced student work cause these few boxes to expand rapidly into an infinite variety of fasteners, findings, fittings, and accessories.

Bins are the typical industrial storage solution but are not always best for school shops. An industrial-arts shop rarely needs the large quantities on hand which call for bin storage and, in addition, often has the problem of misplacement of items. Bins provide an "easy out" for the careless student disposing of one or two bolts—he merely tosses them into the first open bin available. In addition, bins are often difficult to clean.

Cabinets with drawers are available commercially and range from large and and bulky drawers to very small plastic containers. Here a midrange seems sensible. The large drawers, when filled with a variety of hardware items in separately divided spaces, can get far too heavy for the younger students to handle safely. The very small plastic or metal containers, on the other hand, are limited in the number and size of items they can handle. The visibility of items in plastic containers is often a point in their favor, although how long the visibility will remain when scratches and oily dirt accumulate is a question.

The cardboard boxes in which most supplies are delivered are sufficient for storage only when the item has a rapid turnover or when the instructor alone handles the item. The latter procedure is rare and not advisable as students should be learning to handle the supplies. The teacher's time should be used to advantage in teaching, not in constant doling out of driblets of small hardware. Students, even when carefully trained, will often misplace covers, accidentally tear seams of poorly constructed boxes, or misplace boxes that are easily carried about.

One of the better storage drawers available is the type that pulls almost all the way out. The drawer will tilt downward slightly and remain in position without additional support. Removal is simple by lifting up on the front of the drawer so the bottom rear clears the catch. These drawers are difficult to spill and yet can be easily removed to the job or for cleaning. Labeling and keeping contents orderly may be a student personnel organization position for a supply foreman. Variety in drawer size is necessary when the instructor plans to store various items such as abrasive cloth, buffing wheels, molding patterns, etc.

Supplies in liquid form, especially bulk storage of finishing materials, require shelving which may also be preferred for other odd-sized items. Finishing supplies, however, present the added problem of safety. Prevention of accidental fires, of use of the wrong materials, or of spilling, dictate use of closed shelving of metal. Adequate space should be provided to avoid hazards developed when shoving containers aside to get out a particular material from the back of the shelf. A tip from kitchen planners may be of use here. Many designers advocate a wall cabinet which is only one container deep. Every item can be easily reached and, if properly labeled, can be quickly located. A strip of wood or metal on the front edge of each shelf holds the item in place.

Generally it is good policy to keep small containers of finishing materials for immediate use at the finishing work stations. These will minimize waste and spillage. Good containers for such liquids as turpentine, alcohol, lacquer thinners, and others are polyethylene plastic bottles. These do not break if dropped, are impervious to most liquids, and have the advantage over cans of having the contents semi-visible. Need for refilling can be easily checked without the necessity of opening or shaking. Such bottles are also a boon to instructors who keep in stock various acid solutions for etching and other purposes as glass acid containers require extreme care in handling.

Most supplies in small-scale foundry areas can be stored readily through the use of molding boxes. The upper section contains molding sand and can be arranged to hold parting sand and some tools on an enclosed shelf. The lower section beneath the molding-sand bin can be enclosed with a hinged lid and designed to contain flasks, riddles, the remaining tools, and the metal pigs ready for melting. Such an arrangement prevents the messy appearance when miscellaneous molding tools are stored in the open.

Project Storage

Project storage should be planned to minimize confusion when students obtain or replace parts of their projects. The open shelf without an assigned place for each student leads to a constant series of lost small parts, accidental or purposeful misappropriation of parts, and general confusion at the beginning and end of class periods. Lockers can, in some cases, provide the answer if there is sufficient space for them, but they are usually too small to contain larger components and assemblies. Compartmentalized shelving probably serves as well as any method where it may be easily varied in size and shape. With

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MATERIALS LIST

Tots' Dining Set (One Table and Two Stools)

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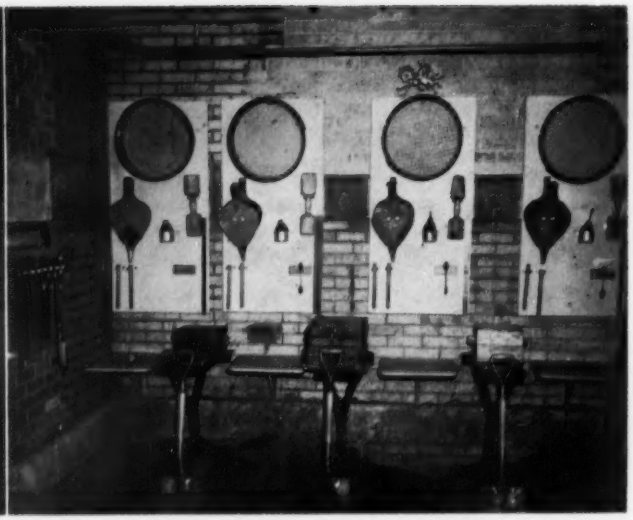
12	¾" Aluminum Floor Flanges
1 pc.	¾" Plywood, 27"x30"
2 pcs.	¾" (1⅛") Clear Pine, 9⅛"x14"
32	¾" —No. 10 F.H. Wood Screws
16	1¼" —No. 10 F.H. Wood Screws
8	1" —No. 10 F.H. Wood Screws
12	¾" Rubber Crutch Tips (White)

(Two Extra Stools)

1 pc.	¾" dia. Aluminum Tubing, 6 ft. long
8	¾" Aluminum Floor Flanges
2 pcs.	¾" (1⅛") Clear Pine, 9⅛"x14"
32	¾" —No. 10 F.H. Wood Screws
8	¾" Rubber Crutch Tips (White)

Open tool panels in the Brockport, N.Y., High School general shop make neat appearance. Cut-out in forging panel makes room for thermostat.



Wall panels are used for tools and equipment in the foundry area of Harding High School, Warren, Ohio, shops. A missing slick is easily noted.

advanced students, however, even this must be supplemented. Such projects as wrought-iron furniture bases and other bulky items require floor space for safe storage. To present a neater appearance in the shop, open shelving storage in a separate storeroom is desirable.

Separate storage for adult classwork is often overlooked in shop planning until the need is discovered. Adult students can remove their work after class but it is extremely inconvenient. In metal classes where advanced students are not limited in the type of work they may handle, some rather weird situations can develop. Sets of ornamental iron rails, handsome large metal trays, and welded steel picnic table bases are examples of work in progress that require outsize facilities. Storage space must be available or the size of the project curtailed. In order to maintain the interest of capable adult evening-class students, it is better to plan well in advance to have plenty of space set aside for storage.

Tool Storage

The prime requisite of tool storage is availability. This may be answered in different situations with a variety of approaches. A central tool panel may be the answer in one place, small localized panels may serve in another, while in still others movable panels are best. A combination of two or more methods serve some needs better than any one system. In a large shop, the single central tool panel is questionable at best. It is virtually certain to add to general confusion with students moving around more than necessary and losing work time. The central panel has the one major advantage of being simple to check for missing tools. Of dubious advantage is the large flashy panel containing all of the tools in the shop, especially when, for example, the forge tools can be obtained only by walking the length of the shop. At the other end of the scale is the further questionable system of duplicating a large number of tools so each student may have a complete set available at his bench. Except in rare situations, most of this duplication is unnecessarily expensive and unwarranted.

In many shops small tool panels are placed near the center of operation of each general metal unit. A small panel containing sledges and tongs is near the forge; another near the sheetmetal area contains seamers, rivet sets, and similar tools; and other panels are carefully placed for the best distribution and return of tools with least loss of time. Some minor duplication is obviously necessary here, such as various hammers and pliers needed in different work areas. Placement to allow visual checking from a distance makes it unnecessary to move around the shop excessively. A good student personnel organization will have one student in each area responsible for a tool check.

The more expensive tools certainly should not be left out on the general tool panels. Such items as micrometers, verniers, and other gages are best kept in steel or wooden cabinets. Accuracy can be best preserved if such tools receive constant attention with oil and are not placed where dust and dirt or rough handling will damage them. The extra care in their use is also more easily taught when students realize that, although they are available for use, they have a special container and require careful handling. A machinist's chest or small felt-lined boxes placed in a cabinet provide motivation in the promotion of such care.

Auxiliary machine parts are best kept near or in the machine base. Such items as various welding tips and sheetmetal forming machine rollers should be within reach of the particular equipment being used. Unfortunately, much equipment on the market is designed so that the bases upon which they rest are difficult to convert into storage space. A few firms offering equipment for school shops are beginning to develop machine bases usable for storage. Instructors, with a little ingenuity, can usually find some portion of the base to convert for parts storage. Bases can be built to specifications in the wood shop for use of otherwise wasted space.

Printed Materials

Books and reference materials should generally be housed in a planning area. Taking such materials to the job is often necessary but conducive of rough treatment. Well arranged shelving and a student librarian will help insure their return in the shortest possible time with the least damage. Shelving with glass fronts is to be avoided, not only as a safety hazard but also as a psychological preventative of student use of the materials. The materials are bought for use and the slight added chore of dusting is worth the benefit of having books ready for use merely by reaching for them.

Current magazines and pamphlets on open slanted shelves combined with the bookcase puts them in a readily available position to be used. Students are much more likely to pick up a magazine when the cover is visible than when it

(*Continued on page* 132)

How we handle

The Storage Problem in the Radio and Television Shop

By Donald B. Orrel

Head, Electronics Technology Department, Oregon Technical Institute, Oretech

TWO equipment and tool storage rooms, one serving advanced students in the television laboratory area, have satisfactorily solved storage problems in the radio and television technology and electronics technology areas at Oregon Technical Institute.

Our classes have a combined enrolment of more than 100 students, so Institute policy is followed in that we require personal ownership by each student of at least the minimum hand tools for an occupation. Major instruments are furnished by the Institute, stored, and issued in a central tool room located within the particular instructional area.

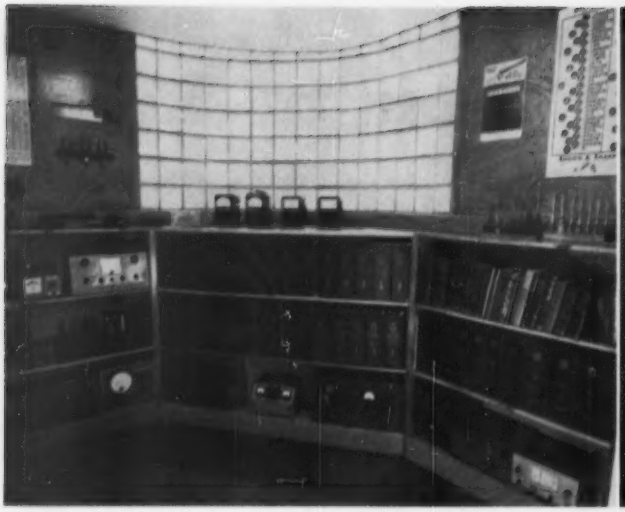
On a rotational basis, students are assigned to work for one week as storekeeper. Tools are issued as requested and the storekeeper is held responsible for return of those items at the end of each class period. As each tool is issued, it is listed and signed for by the receiving student, and tool return is then checked against the list.

Test leads and probes, taped together

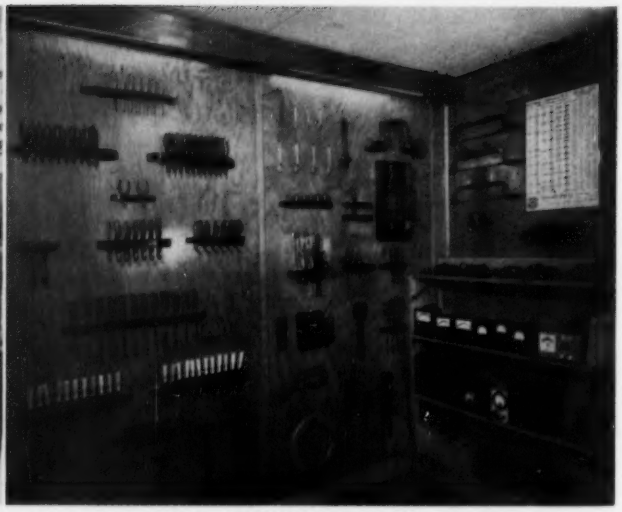
Radio laboratory tool room at Oregon Technical Institute. Each window serves a shop while Dutch door in foreground opens into TV lab. Lower shelves are for storing student projects.

Oregon Technical Institute has two equipment rooms: one serving advanced TV students, the other for those in radio.

Left and right sides of TV tool room at Oregon Technical Institute. Small parts are stored in the old dental cabinet (rear), service manuals in a filing cabinet. Students are storekeepers.



Tool room in the electronics department of the McDowell Vocational School, Welch, West Va., is operated on the honor system without loss.



Another view of McDowell TV tool room showing indirect fluorescent lighting. Ceilings are of acoustic tile. Room is used for library and storage.

and identified in sets, are kept in adjacent, slotted racks for issue with instruments as may be required. The tool room is so arranged that it serves students from the two separate shop areas on that floor simultaneously. Entry to the tool room is possible only from the main corridor and no individual other than the assigned student storekeeper is permitted inside the tool room, where small parts, tubes, etc., are also stored and issued from parts bins. Issues of this nature are made only after authorization by the instructor.

Each storekeeper is responsible for maintaining all instruments in usable condition during his period of duty and reports to the instructor any which he is unable to repair. This practice gives each student valuable related experience in stores work as well as instrument maintenance in conjunction with his major learning program.

The second tool and equipment room, provided for the television laboratory area, is restricted to use by students in advanced training who are working in the TV lab. Issue here is made only by instructor authorization, and the instructor is responsible for tools and equipment. The tool room here is fitted with a Dutch door, rather than issue windows.

Space is provided in the first tool room for the storage of a maximum of 50 student projects. These are also checked out to the individual student by the storekeeper and returned at the end of the class period. Shelving in both tool rooms is designed for maximum utility and convenience. For instance, vertical spacing is arranged so as to permit the storage of small items on the upper shelves and large pieces such as oscilloscopes and signal generators are stored on the lower shelves. Shelf depth is sufficient to allow the storage of several small items in a single row, and all spaces are marked to identify articles to be accommodated.

Each tool room has its own service-manual library and manuals are issued as required for the completion of a particular student project. A parts list is provided for construction projects. On completion, the project is submitted to the instructor for grading.

The project is then disassembled by the student and all parts are returned to the tool room where they are checked back into stock by the storekeeper. Any shortages or damaged parts are noted and the individual student is held responsible for replacement.

This method has resulted in nearly 100 percent return of all parts in good order. Little or no loss of parts or equipment has occurred since the inauguration of these procedures and storage facilities. All instruments and tools are numbered as state property and carry an electronics department serial number. This number applied with nail polish, is large enough to permit ready identification of missing items.

The system described above has been effective and efficient for us and can be adapted to meet the needs of other schools. ★

Supply room and tool room in the radio shop at South Oak Cliff Senior High School, Dallas, Texas, is enclosed by screen. Projects are stored in drawers under benches with variable voltage outlets.

Helps in handling the problem of

Storage in the Wood Shop

By John L. Feirer

Head, Industrial-Arts Department, Western Michigan College, Kalamazoo

THE story is told of a young teacher who arrived at his first position only to find his wood shop completely empty except for a stack of lumber at one end. Faced with the prospect of having to handle six classes a day his first week, he got the ingenious idea of keeping the students busy by having each successive class carry the lumber from one end of the room to the other and pile it in a neat stack. He didn't have much of a storage problem, at least, not for his first few days of teaching woodworking!

This isn't true of most active woodworking teachers, however, who find storage one of the biggest problems in a never-ending search to find new and better ways of taking care of things.

Check List for Wood Shop Storage

The woodworking area has more storage problems than any of the other shops because most of the materials used are rather bulky and since there is a large variety of things to be stored and maintained. The following check list gives some idea of the many items that must be considered in planning for storage in the wood shop:

1. *Lumber storage.*—Lumber is the most fundamental supply problem in the wood shop. The ideal solution is to have a separate lumber storage room with a door on either end, one door to the outside of the shop at a loading dock and the other door to the inside of the shop near a cut-off saw. This room should be about 10′ x 18′. The next most satisfactory arrangement is to have horizontal storage along one wall of the shop, preferably near the delivery door or an inside wall. This type of rack is not always satisfactory, however, since it uses up at least 17′ of valuable wall space. Some teachers reduce the amount of wall space needed to about 8′ by cutting all lumber in two pieces as it arrives. There is always some extra waste of wood when this is done, however. The best arrangement for horizontal storage of lumber is a pipe or arm rack with the arms set on 8″ or 10″ centers. With this type, one shelf doesn't have to hold too much lumber and the lumber can be kept sorted on arms into the various kinds.

Where wall space is at a premium, a vertical storage rack is a possibility. The extra lumber can then be kept on a balcony over the finishing or other auxiliary room.

In addition to these racks, there should be another for shorts and cuttings. A small portable rack is often the answer.

2. *Plywood storage.*—The best method of storing 4′ x 8′ plywood sheets is to place them on a rack on which the sheets can be stored flat. There should be enough dividers to separate the common kinds and sizes kept in stock. If the sheets must be stored on edge, the dividers should be close enough to let each sheet lean without becoming warped. Plywood should never be leaned against a wall.

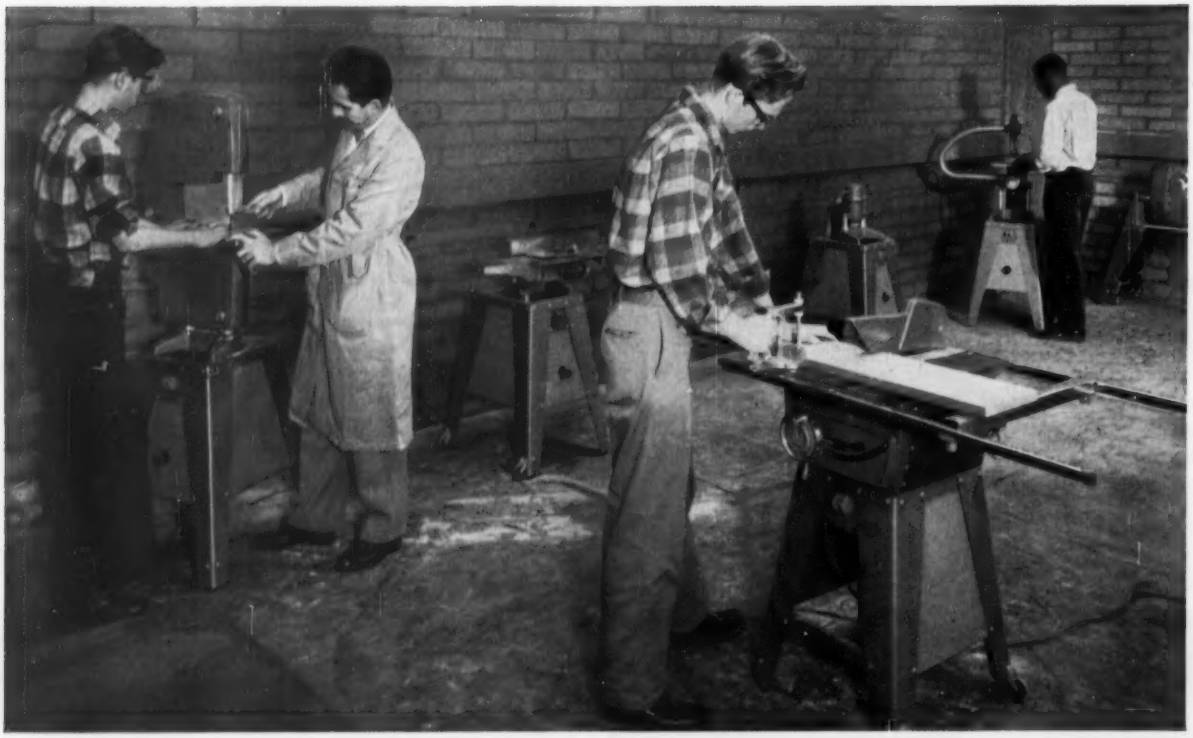
3. *Student storage for project parts, aprons, and other personal items.*—The average shop must have project storage for about 120 to 150 students. The ideal situation is for each student to have an individual locker. These lockers might be part of the base of the benches or

A separate lumber room for the storage of large pieces helps in maintaining inventory in neat shape. Plywood rack is left; cut-off saw is close.

Smaller pieces are stored in vertical rack after removal from lumber room at Reavis High School, Oak Lawn, Ill. Note labels and dividers.

NEW!

Magna presents America's finest school workshop tools



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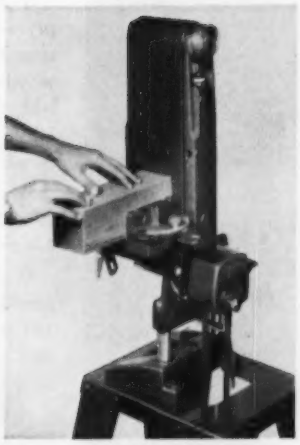

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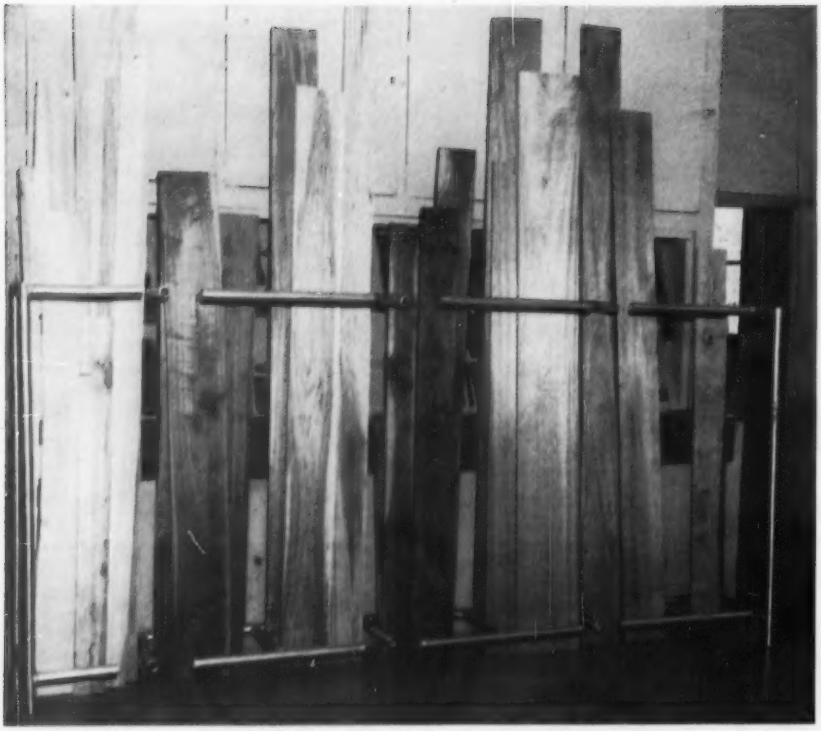

This unique lumber rack fabricated from 1¼" welded pipe was developed by J. C. Low at Charleston, Mo., High School. Rack stands 5' high; lumber removal openings are 10" wide; depth, 12".

work centers with additional lockers built along the wall. The size of these lockers depends on the level of instruction, whether it is junior- or senior-high school. The shop planner should anticipate what kind of projects will be made and plan the storage units accordingly. For example, in the average junior-high school, the parts that go to make up most of the projects can be stored conveniently in a 10" x 12" x 20" locker, but for senior-high school shops some larger lockers should be added. If individual lockers cannot be provided, then at least one large cabinet with adjustable shelving should be planned for each class. Most teachers prefer to have locks on storage units but some teachers have put into practice an honor system that works well.

4. *Project storage room for assembled projects.*—Every shop should have a storage room with adjustable shelving for projects that have been assembled but not completed. Some shops combine this with the finishing room but this is bad practice. This separate storage room is one of the areas most often omitted in planning a new shop. Yet it is one of the most essential facilities for good shop operation. This auxiliary room should have a door large enough to move a desk or other large project in and out easily. A visit to many new woodworking shops often reveals that no provision has been made for this kind of storage. As a result, partly completed coffee tables, cabinets, desks, and other large pieces must stand around the shop, collecting dust, being subject to damage, and cluttering up the shop. If adult classes use the shop, an additional project storage room should be planned. It is poor public relations to expect the community adults to carry home their partly completed projects after every class period.

5. *Finishing room with finishing supply storage and drying racks.*—Recent research shows that 85 percent of the woodworking teachers consider their finishing rooms inadequate. The good finishing room should be a glassed-in auxiliary area with metal, fireproof cabinets for finishing supplies, adjustable shelving for drying, and special storage for nonliquid finishing supplies.

6. *Hand-tool storage.*—There are four possible ways of storing hand tools: (*a*) tool room, (*b*) open tool panels, (*c*) tool cabinets, and (*d*) individual student tool kits.

The most common practice is to use tool cabinets. Tool storage has always been a major problem in a new shop simply because the teacher was expected to build all tool holders and devices himself. This is a long and tedious job and many teachers spent a year or more in a new shop before their tool cabinets were complete. Fortunately commercial tool holders designed especially for wood shops are available now. It is always a good idea to standardize on certain sizes and brands of tools so that additional items can be purchased at any time for replacement. In fact, extra hand tools of each type should always be on hand to make the tool cabinet complete in every detail at all times. A clean-up program begins to break down when some of the tools in the cabinet are missing.

7. *Machine accessory storage.*—Machine accessories are best stored near the machine on which they are to be used. It is usually a good idea to provide separate cabinets for each machine or

Project storage is handled by use of large locker for each class at Jefferson Senior High School, Dallas, Texas. This shop has five lockers and each student has shelf. Teacher has key.

Deck space, which is less expensive than ground-floor space, is utilized for storage of projects at Harding High School, Warren, Ohio. Door can be locked for protection. Shelving is adjustable.

STANLEY SHOP TALK

CATALOG No. 34

This STANLEY TOOL CATALOG with the special school index is a particularly useful book of reference and tool information for the shop teacher.

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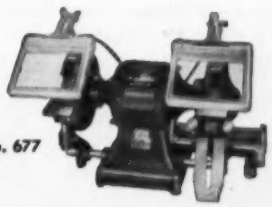

Especially designed for the school shop. The grinding attachment is for all chisels and plane irons up to 2⅝" wide. Equipped with "Flud-Lite" Eye Shields that cannot be moved to non-guarding position.

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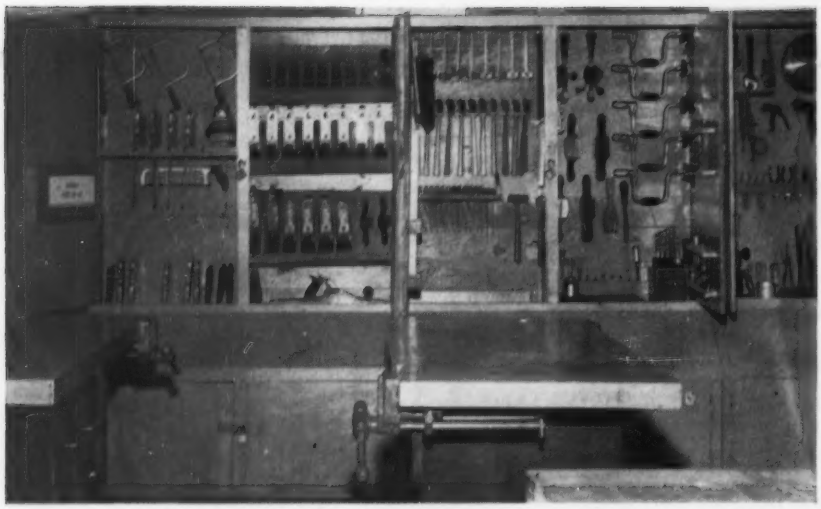
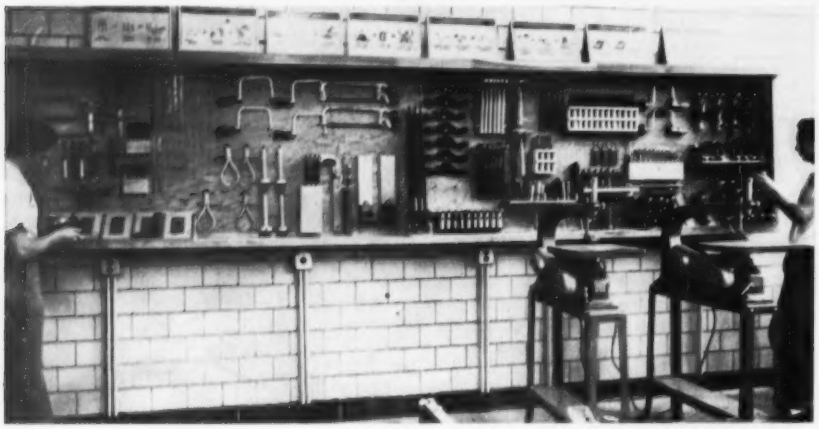


This wall tool cabinet at Tallulah, Louisiana, High School has hinged doors which may be closed and locked. Larger items can be stored on shelves below. Bench bases provide locker space.



Open wall tool panel is designed so that tools used first such as layout tools are placed at one end and tools usually used next are placed in order. Panel is in the Parma, Ohio, High School shop.

group of machines. For example, there ought to be a cabinet for lathe tools, another for shaper cutters and accessories, etc., since these cabinets can be kept locked most of the time.

8. *Metal fasteners and hardware storage.*—A case or part of a case is a necessity for storing nails, hinges, knobs, and other hardware commonly used. The teacher must make careful selection of the sizes and kinds of these items needed. For example, there are over 600 types of wood screws when kinds of material, kind of head, gage size, length and kind of slot in the head (straight or recessed) are considered. Of this great number, the average wood-shop teacher would want to stock perhaps 20 to 30 individual kinds and sizes. This in itself is a problem in deciding which are the most popular sizes and what kind of head slot to select. The trend in many schools is to use the recessed head screws exclusively since they make neater appearing projects. Screws and nails are usually stored in small wood, plastic, or metal boxes. Some teachers like to color code these so it is easy to identify the items and to make sure that they are easily returned to their places.

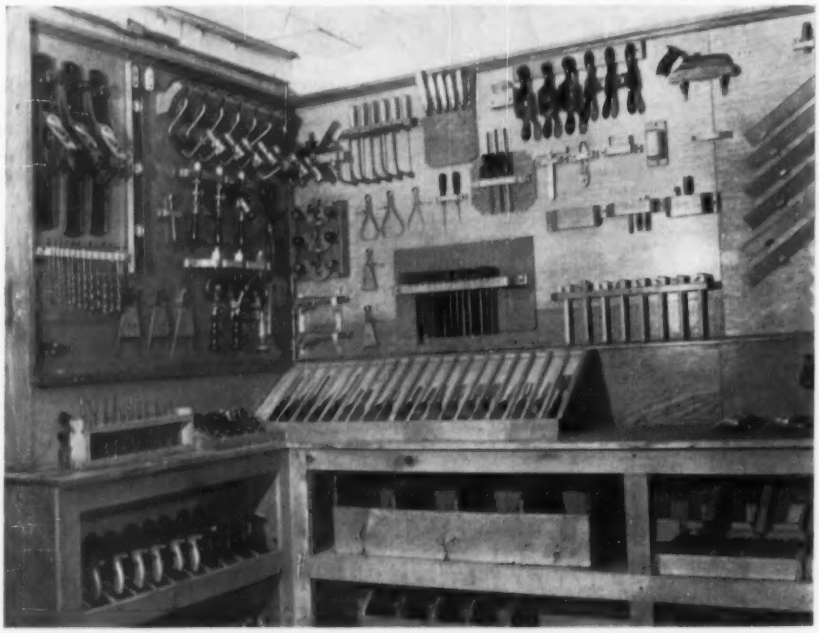
9. *Teaching materials storage.*—The teaching center should include a demonstration bench, a chalkboard with storage cabinet, and visual-aids storage cabinets. There should be a good place to keep models, mock-ups, large charts, and other items used in demonstrations and lectures. A movable storage cabinet for storing film strips and projector is also desirable. This storage cabinet can be used as a projection stand. The movie screen should be mounted above the chalkboard or the new type of chalkboard should be provided that can be used for both blackboard illustrating and as a screen.

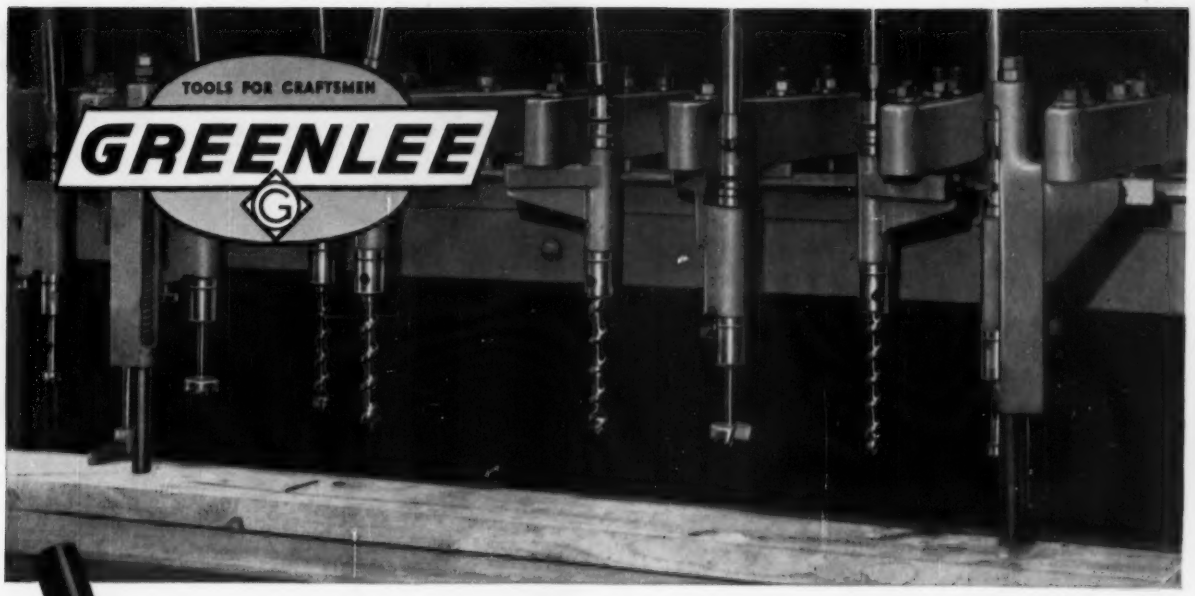
10. *Instructional materials.* — Books, magazines, manufacturers' literature, and other instructional materials that make up a shop library should be stored in a case that is convenient to the planning table. These materials should be readily available to the students for project planning and designing.

11. *Extra storage for small tools and supplies.*—A cabinet in a store room should be available for a supply of extra hand tools, materials, and other small items. These are the things that only the teacher has access to for replenishing the materials and tools in the cabinets available to the student.

12. *Small supply storage.*—Part of a cabinet should be provided for such items as sandpaper, dowel rods, and other similar items.

Tool crib in the carpentry shop at the Middlesex County Vocational and Technical High School, New Brunswick, N.J., shows several distinctive tool holders. Note hammers in slots in bench top.





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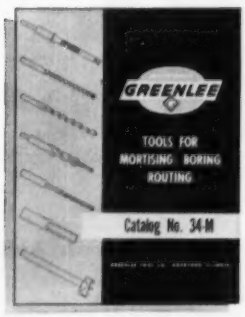

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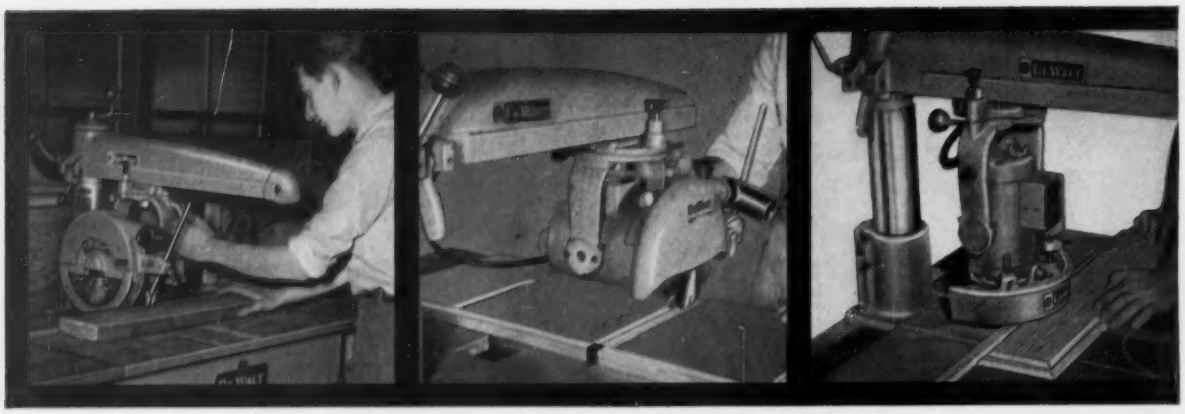

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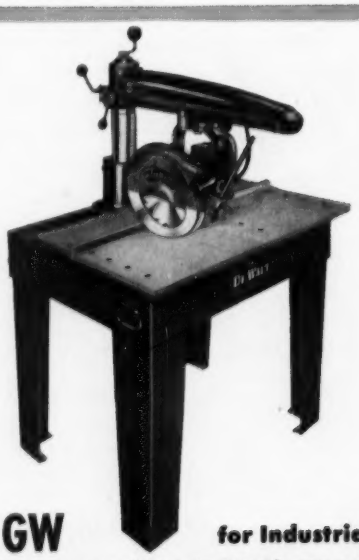
Uniform box-section non-retractable cantilever arm rotates 360° around the supporting column. Top-elevating crank. Quick-set miter locating latches at 0° and 45°. Eight (8) ball-bearing roller head rides directly on machined trackways inside arm. Direct-drive, totally-enclosed, fan-cooled motor (3425 r.p.m. full load), manual thermal switch. Calibrated miter, bevel, and rip scales, positive bevel-locating latches 0°, 45° and 90°. Steel table with legs, wood top. 14" diameter automatic safety guard with kickback device. (Select motor, saw blade and arm size from models shown below.) Power safety brake (optional).

Model	Std. Saw Blade	H.P.	Motor 3425 R.P.M.
GAK	12"	2	Single-phase, 60-cycle AC, 115/230 volts
GAN	14"	3	Three-phase, 60 cycle AC, 220/440 or 550 volts
GAO	14"	3	Three-phase, 60-cycle AC, 115/230 volts
GAR	14"	5	Three-phase, 60-cycle AC, 220/440 or 550 volts

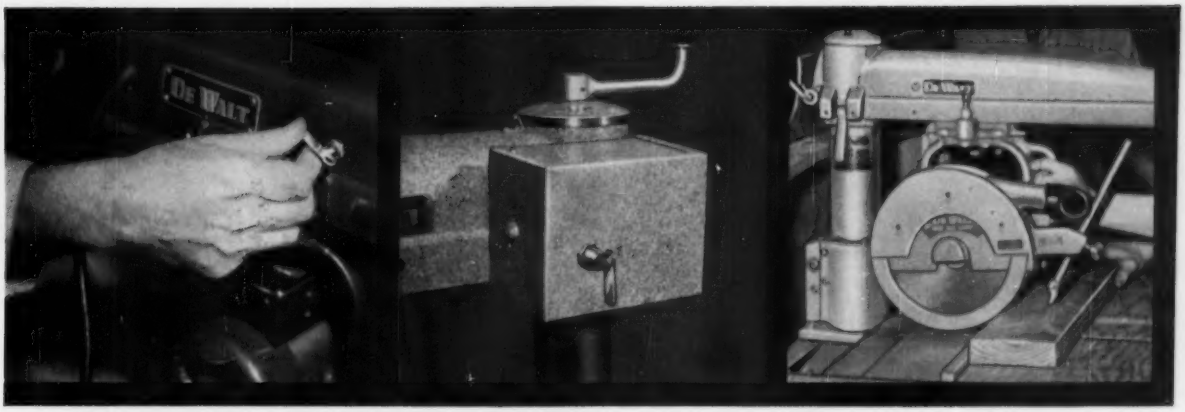


MODEL GW for Industrial Arts

10-inch radial arm saw, cuts 3" deep, rips 26" wide, cross-cuts 16" x 1". Uniform box-section non-retractable cantilever arm rotates 360° around the supporting column. Top-elevating crank. Quick-set miter locating latches at 0° and 45°. Four (4) ball-bearing roller head rides directly on machined trackways inside arm. 1½ h.p. direct-drive, protected, fan-cooled motor (3425 r.p.m. full load), manual key switch. Calibrated miter, bevel, and rip scales, positive bevel-locating latches 0°, 45° and 90°. Steel table with legs, wood top. 10" diameter saw and "Auto-float" safety guard with kickback device. Power safety brake (optional).

Model	Saw	H.P.	Motor 3425 R.P.M.
GW-1	10"	1½	120/240 volts, 1-phase, 60 cycles AC
GW-M	10"	1½	220, 440 or 550 volts, 3-phase, 60 cycles AC (Specify One Voltage)

AC 2-phase or 50 cycles available on request for GA and GW.



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You need De Walt SAFETY. *Only the AMF De Walt® Power Saw* offers you such a combination of safety features.

Top-side cutting action lets the operator see the blade *and* the layout mark for every cut. Blade action holds the material down and against the fence for added safety. *Pull-across cutting* lets the operator move *with* the saw for most cuts, not against it as with other tools. *All controls are above* the table and clearly marked for safe, sure set-ups every time. *Original Safety Key Switch* prevents unauthorized use. *Work is always level* and moves in a straight line—you fit the *saw* to the *work*, not vice versa as with other tools. No balancing lumber at awkward and dangerous angles. *Exclusive tool guard* adds still greater safety—completely encloses shaper knives and other tools, yet adjusts to any size lumber in seconds. *Special De Walt Power Brake* stops saw blade in a few seconds for maximum protection. *Spir'Ator Safety Return* automatically draws motor and blade to a safe position when released.

You need De Walt EFFICIENCY. One De Walt Power Saw actually does the work of *12 different power tools*—and does each one *as well or better* than a single purpose machine!

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You need De Walt PRACTICALITY. No other single piece of woodworking equipment makes as much "sense" as a De Walt in your shop, because no other offers such practical advantages.

With De Walt's great versatility, you can often save the cost of a number of other machines which frequently stand idle. Your De Walt will be the most-used machine in the shop. The De Walt can be placed and operated *against a wall—takes up 75% less space than old style table saws*. And with a De Walt, you can be sure you are training your students on the kind of equipment they will later use. For De Walt is the choice of woodworkers throughout industry—for carpentry, construction, pattern shops, cabinetry, maintenance and crating departments—tried and proved by *millions* of operators.

You may have seen the De Walt Power Saw demonstrated at the National or your State Convention. If not, see your Dealer for a demonstration. Send the coupon below for your FREE copy of "Job-Tested Cutting Methods". Valuable new shop teacher's aid now available—"Easy Ways to Expert Woodworking"—just $3.95.

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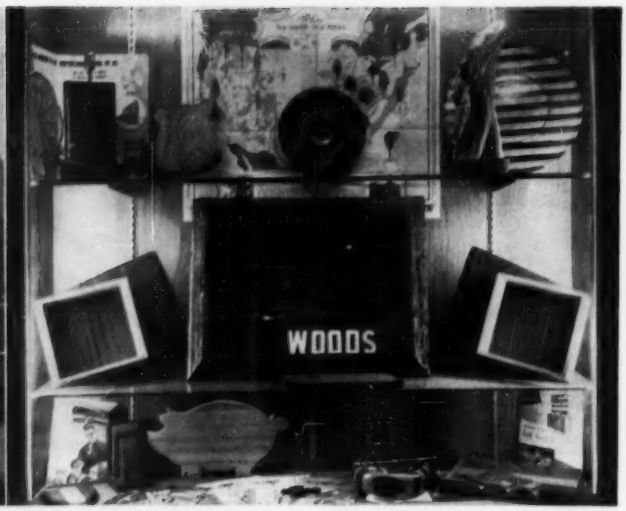
This tool and accessory board on a wood lathe in the Palmyra-Macedon, N.Y., Central School is a set-up which is easily checked by the teacher.



This attractive display case just outside the wood-shop door at the Reavis High School, Oak Lawn, Ill., helps greatly in publicizing shop activities.

13. *Upholstery supply storage.*—Senior-high school wood shops should have storage for such upholstery materials as tow, cotton, muslin, webbing, springs, cane, and other things. Most of these things are bulky and large pull-out containers in or near the lumber storage should be planned. Sometimes a specially fitted upholstery bench with large drawers is used for this storage.

14. *Teacher's wardrobe.*—One storage cabinet should be provided for the teacher's personal wardrobe, his shop coat, and outer clothing.

15. *Cleanup materials.*—Most teachers want a storage cabinet for brooms, dustpans, vacuum cleaner, and waste cans.

16. *Display cabinet.*—A display cabinet, preferably facing into the hall of the school building, should be included to show the work, projects, and activities of the wood shop.

17. *Drawing equipment.* — Drawing equipment storage is often desirable in a wood shop if the teacher emphasizes the designing and planning of projects.

The Need for Better Planning

While most of these needs seem rather obvious, it is surprising to see how few new shops are being planned with real thought given to the solution of storage problems. Today, the house architect has been so concerned with the problem that he often plans a house around the storage needs of a particular family. The storage wall between bedrooms, the built-in cabinets in the family room, and the specially designed cabinets in the kitchen are all a part of this concern for proper storage. Yet, we see most of our new schools being built with little or no thought given to a need that is as great if not greater than that of the home. Most new woodworking shops appear to have been designed by the architect who took the space that was left over after he had met the needs of the rest of the school and said:

"Here's a rectangular area that we can use for a wood shop. Maybe we should put a little storage room in one corner."

How often have you gone into a new shop lately to find that there was no place for keeping lumber or plywood or where no thought had been given to project storage?

As educators planning new shop facilities, we have been partly at fault. We try to design shops with too little square footage per student. Recently I talked with a supervisor of industrial arts in a medium-sized city in the midwest. He was planning two new shops, one a metal shop and the other a wood shop for a new junior-high school of about 900 students. Each shop was to have an average class size per period of 30 to 35—

This tool cart was developed because of lack of wall space for a panel at the Yakima, Wash., High School. It is narrow enough to go through doors so it can be locked in a store room and low enough so teacher's vision of shop is clear.

far too many for good industrial-arts instruction. Yet, he was happy because he had convinced the administration to give him a total of about 2700 square feet for both shops, or about 1350 feet for each shop!

Planning and Remodeling a Shop

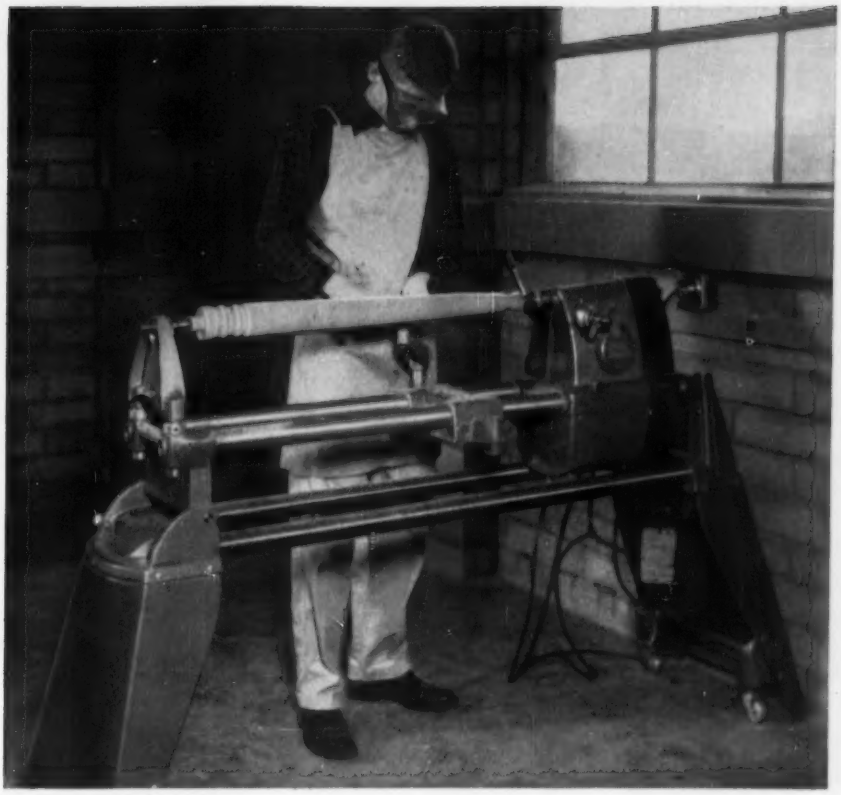
Most woodworking or general-shop teachers will find a personal need for studying the storage problem in their shops. During his career in teaching a teacher will have to face at least one if not both of the following situations:

1. *Planning a new shop.*—The next 10 years will see the largest enrolment in the secondary school in our history, so there is a good chance that teachers will help to plan new shop facilities. This is a wonderful opportunity to get a really well planned shop. A check of the plans for a good senior-high school wood shop will reveal that every possible kind of storage in the above check list has been adequately provided. There is student storage in all of the student work centers as well as in storage units along the wall. All other types of storage are also well planned. This demands a good sized shop. A shop planned for 24 students should have 3200 square feet, or about 133 square feet per student.

2. *Remodeling an old shop.*—When remodeling an old shop, the two pressing problems are usually getting enough space for storage and insuring adequate electrical service. Added storage can often be obtained by taking over another room adjacent to the shop.

The next 20 years should be the golden era of expansion in industrial arts. Let's make sure we get shops in which we can do a truly great job of teaching. This means good storage and plenty of it. ★

Solve traffic jams in your shop!



SHOPSMITH IS WHATEVER TOOL YOU NEED MOST AT THE MOMENT

All of a sudden everyone in the shop needs a lathe — or a drill press, or a saw — and every available tool is tied up. In seconds, your versatile SHOPSMITH® solves these traffic pile-ups! Simply convert it (in less than a minute!) to the tool you need most — 9" Saw, 12" Disc Sander, 16½" Drill Press, 34" Lathe, or Horizontal Drill with unlimited capacity, and each a superior, precision tool.

Rugged SHOPSMITH is the safest power tool ever designed. Exclusive Speed-Dial gives you correct tool speeds (700 rpm to 5200 rpm) for any operation. All belts and pulleys are enclosed with the built-in ¾ hp motor. Guarded safety-switch. Over-under saw guard. Special school model SHOPSMITH is priced to stretch your shop budget. Mail the coupon today for full specifications and details.

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TURNING—Lathe with 16½" swing; 34" between centers. Tool rest slides parallel to work. Exclusive taper turning!

BORING — Horizontal Drill with unlimited capacity! Precision depth-control dial on quill feed—another exclusive!

SPEED-DIAL—Instant selection of correct tool speeds. Exclusive Power-Shift from 700 rpm to 5200 rpm!

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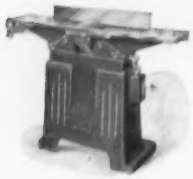

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Used in over 2360 leading vocational shops

The outstanding efficiency of Oliver equipment in dollars and cents is being proved every day on factory floors. The Oliver-trained student learns more on the machines used by industry.

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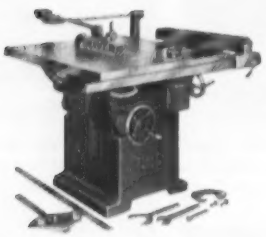

Students soon find Oliver machines can be set up quickly and accurately. Self-locking devices keep the machines in perfect adjustment.

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Band Saws	Tenoner
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Borers	Surfacers
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Woodturning Lathes	Benches and Vises
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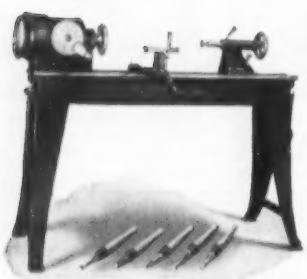
Let us send you bulletins containing full details on the machines that interest you.



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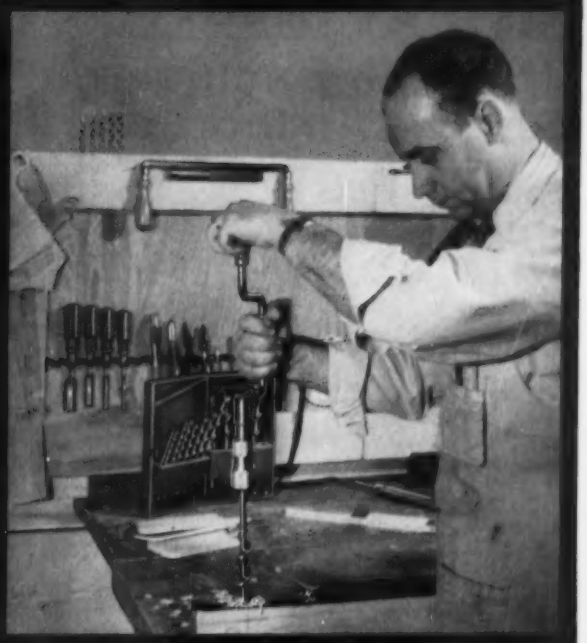
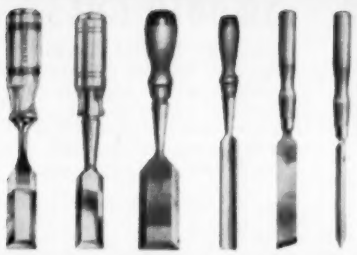
GREENLEE 22 SOLID-CENTER AUGER BITS

Made with utmost care to assure free, easy boring and fast chip clearance. Solid-center design for extra strength, smooth operation. Accurately sized, perfect cutting edges. "Plastic-Sealed" to reach you factory-sharp. Can be purchased singly or in handy bench sets and steel boxes as shown at right (also in plastic rolls).

Better Shopwork with fine hand tools by GREENLEE

Good workmanship comes easily with GREENLEE tools. All are carefully formed and finished for accuracy and correct cutting edges and are properly heat-treated for long life. They are made by craftsmen for craftsmen.





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Various types of tang butt, socket butt and firmer chisels with durable green plastic or hickory handles. Outside and inside bevel socket gouges. Short and full-length turning tools.

EXPANSIVE BITS, DRILLS, ELECTRIC-DRILL BITS

Fast, easy-boring expansive bits with positive chip clearance. Two styles: Setfast with quick adjusting-locking feature, and Plain type. Wood-boring brace drills and solid-center electric-drill bits in various sizes.

SPIRAL SCREW DRIVERS, PUSH DRILLS, DRAWKNIVES

Free-running, fast action GREENLEE spiral screw drivers are available in two models: Enclosed Spiral for extra safety and grit-free operation, and Open Spiral. Automatic push drills are smooth operating with automatic spring return . . . handle holds eight drill points. GREENLEE drawknives are light in weight and have sturdy, rigid blades for accurate work.

The GREENLEE line also includes many other time-saving tools for students and shop workers: Bit Extensions, Electricians' Bits, Tubing Benders, Radio Chassis Punches, and many more. Write for free catalog No. 35-H.

TOOLS FOR CRAFTSMEN

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Try to match THIS for price and performance!

NEW

Yates-American Jointer

...with exclusive Shear-Cutting Fence*

Cuts clean —even across knots!

Big, Big Table!

64 inches long
on 8″ Model J-138

50 inches long
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Low, Low Price!

only $118.75

for 6″ model, less motor, switch, and cabinet

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Many other new features, including DELUXE SAFETY GUARD which allows stock to pass under the guard, for maximum protection of students. Get all the facts—send coupon for Bulletin PT-26.

Smooth, Smooth Cut!

Fence at "normal" position is at 90° to head. "Shear" position, at 10° angle, gives shearing action at point of cut for extra-smooth finish, even on unusual grained hardwoods and knotty stock.

Tear out coupon and mail today!

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Diamond Dust

Abrasive comments from that doughty Scot, Tom Diamond, former head, Department of Vocational Education, University of Michigan, Ann Arbor.

A Place for Everything But—

AN optimist is a guy who continues to hope that a Scot will reach for the check after he has been dining or drinking with a group of his associates. A person who travels so far astray in his thinking really reaches the ultimate in optimism, because any student of history will assure you that there is no case on record where a Scot has been known to make even a modest gesture toward paying for anything.

Sad to relate, we have found Joe Doakes, who is a shop teacher, and naive enough to believe that such an occurrence is a possibility. He has formed the opinion that the world is a pleasant place in which to live. Only on rare occasions does he become disturbed. Even when some careless youngster wrecks the planer blades by planing the head off a ten-penny nail, he takes comfort in the thought that the result is less annoying than it would have been had the lad attempted the same experiment by using his fingers.

When he comes to school in the morning, he is at peace with the world and radiates goodwill to all men. When his class assembles, he proceeds with his demonstration and, because he is an inspiring teacher, his students become enthused about their work, proceeding to the activities of the day with confidence.

But suddenly the calm serenity of the scene is changed. A potential riot has been started somewhere in the dim recesses of the locker area. On inquiring into the cause of the disturbance, Joe finds that a difference of opinion has developed in regard to the ownership of a particularly attractive piece of material. So Joe found himself forced into the position of becoming an arbitrator. Had he been familiar with the biblical story of Solomon, who proposed to settle an argument between two mothers who claimed the same child, his task might have been easy. Lacking this knowledge, he decided to confiscate the material in question, which annoyed both parties to the argument and destroyed the harmonious atmosphere that prevailed when the class started.

The real cause of the incident stemmed from the fact that facilities for storing unfinished work had not been provided, with the result that unfinished parts were stored in corners of the room or on top of the lockers. Since there were several classes using the shop, confusion could hardly be avoided when parts belonging to different students, from different classes, were mingled together in a single pile.

By the time Joe had settled this dispute to his satisfaction, but not to the satisfaction of either student, his sunny disposition had become a little cloudy. And the density of the cloud increased when a student reported that he had been unable to locate the 1" brads. This seemed to be a small matter, but it ranked high in the mind of the lad, since he could not proceed with his work until they were found.

"Where did you look for them?" Joe inquired.

"Why, I looked all over the shop for them," the youngster replied.

He looked "all over" because there was no single spot where they should have been. As a matter of fact, Joe finally found them in the bottom drawer of his desk.

Joe was annoyed still more when a

SHELDON

Builder of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes

It only takes one good Milling Machine and a capable Shaper to triple the value of your shop course

No course in shop practice can be complete without basic instruction on the milling machine and the shaper.

For this no other units equal the size "0" Sheldon Milling Machine with its hand and power table feed, quick-change gear box, variable speed drive, back geared unit, and interchangeable vertical milling head attachment. No other shaper is better suited for class work than the ample size Sheldon 12" Back Geared Shaper with its large capacity, long stroke, variable speed drive, weight and accuracy.

These are standard machine tools with which you can teach modern methods and tool performance—— full powered industrial tools that can give your students the "feel" experience and satisfaction of adult work.

Sheldon provides today's modern school shop with "up-to-date" machine tools . . . with 10", 11", and 13" Precision lathes for both industrial arts and vocational programs . . . Sheldon Milling Machines . . . Sheldon Shapers . . . and, for advanced courses, Sebastian 13" and 15" Geared Head Lathes.

BASIC TEACHING AIDS

In addition to providing conveniently located distributors with experienced sales engineers, Sheldon prepares and publishes basic teaching aids, for shop instructors.

Write for samples today——

SHELDON MACHINE CO., INC.
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boy stubbed his toe on some steel rods which were parked on the floor at the end of the shop. As a result of this incident, the boy became a subject for first aid, which affected Joe's safety record adversely.

By this time Joe's day was wrecked and with it his optimistic outlook on life was changed to one of pessimism. However, it had the effect of awakening him to the need for storage facilities. He registered a vow that one of the first things on his list for improving his shop was to devise storage facilities that would eliminate the irritations arising from the lack of them. *Go thou and do likewise.* ★

happenings in industrial education

AIAA Convention

INDUSTRIAL-arts teachers attending the 19th annual convention of the American Industrial Arts Association, April 23-26 in Kansas City, Mo., have a full schedule of activities planned for them.

The keynote address of the convention on Wednesday will be given by Lindley Stiles, dean of the school of education, University of Wisconsin, who will speak on "Developments Affecting Education in America." Exhibits open April 24.

Other industrial-arts leaders who will speak at the major sessions include John Fuzak, coordinator of industrial arts, Michigan State University; H. H. London, professor of industrial education, University of Missouri; Dewey Barich, Ford Motor Company; Delmar Olson, Kent State University; Kenneth Perry, Colorado State College; and Fred Baer, supervisor, Los Angeles, Calif.

Meeting just before the general sessions of the AIAA will be the American Council on Industrial-Arts Teacher Education and the American Council of Industrial-Arts Supervisors. R. Lee Hornbake, University of Maryland, will be in charge of the former group; and G. Wesley Ketcham, Connecticut State Department of Education, will be in charge of the latter.

Gardner Boyd, supervisor of industrial arts for the Kansas City Public Schools, is general chairman of the convention committee.

Summer IA Exhibit

PLANS for a semipermanent exhibit in Philadelphia this summer on the theme "Forward through Industrial Arts" are being made by a joint committee of the AIAA and the industrial-arts division of AVA.

An exhibit space of approximately 7000 square feet in the Philadelphia Commercial Museum will be available for the exhibit from June 15 until September 15. This means that the exhibit will be open during both the NEA convention to be held in Philadelphia the end of June and the AVA convention to be held in August.

According to present plans, the exhibit will trace the history of industrial arts back to the Russian exhibition in Philadelphia in 1876, show its activities today, and picture industrial arts in the future. It is also planned to have at least two model shops set up under the leadership of John Smith, New Jersey supervisor of industrial arts. Plans call for all areas and territories of the U.S. as well as the Dominion of Canada to be represented in the exhibit.

William T. Kelly, assistant director, vocational and secondary industrial arts, Philadelphia, is in charge of making arrangements for the displays.

Missouri Officers

GORDON O. JOHNSON, Missouri State Department of Education, has been elected president of the Missouri Industrial Education Association.

Lester B. Swaney, Clinton High School, was chosen vice-president; and

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- 16" Saw Rips 4" Stock
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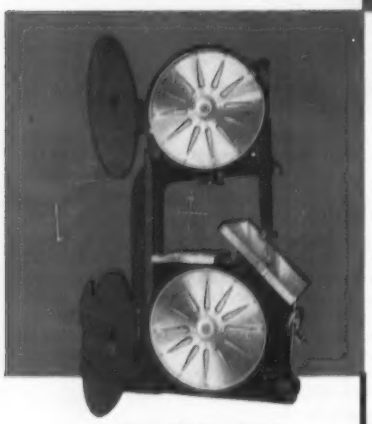

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METAL CUTTING MODELS AVAILABLE!

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Extended tables for either right or left hand . . . to suit your production set-up.

Write TODAY for complete specifications

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World's Oldest Manufacturer of Woodworking Machines
2004 Eastern Avenue
Cincinnati 2, Ohio

H. H. London, University of Missouri, was named secretary-treasurer.

Three Years Work

FOUR drafting teachers and a director of vocational education saw the fruition of three years work when the Minneapolis, Minn., Public Schools recently published their junior-high-school handbook for mechanical drawing, sketching, and blueprint reading.

Members of the committee who worked on the handbook were Harold Tietz, Minneapolis Vocational High School; Robert Means, Bryant Junior-High School; Joe Horkey, Nokomis Junior-High School; and John Robohm, formerly director of vocational education, now retired.

IA Officers Named

NEWLY-elected president of the Washington Industrial Arts Association is Charles B. Thuot, of Kennewick.

Melvin Kirkland, Seattle, is the new vice-president; and Wallace Bennett, Kennewick, is secretary-treasurer.

Summer Workshop

THE second annual Minnesota Industrial Arts Summer Workshop, planned by the Birch Coulee Industrial Arts Club in cooperation with the State Teachers College, Bemidji, Minnesota, and the vocational division of the Minnesota State Department of Education, will be held this year from August 18-24.

The workshop, which again will be at the State Educational Camp, Lake Arrowhead, will be on the machine shop, including the use of the metalworking lathe in the general shop. O. D. Lascoe of Purdue University will be the head instructor.

Michigan Meeting

MORE than 200 persons attended the annual meeting of the day-trade teachers of Michigan at Michigan State University, East Lansing, February 8-9.

Although called by the Michigan State Department of Vocational Education, the meeting was planned and carried on by the teachers themselves. They selected the subjects to be discussed, secured the speakers, and assigned the chairmanships. Speakers at the general sessions included Mrs. Mary Resh, T & I branch, U. S. Office of Education; Mrs. Lillian Monash, Michigan Employment Security Commission; Dewey Barich, Ford Motor Company; and James Whyte, Detroit representative, U.S. Bureau of Apprenticeship.

Representatives from the ranks of labor and management, and directors, principals, and superintendents attended the sessions as well as shop teachers. Augusta Ochs, principal of the Goldberg Trade School, Detroit, acted as general chairman. ★

Convention Calendar

Illinois Industrial-Education Association, Hotel Sherman, Chicago, April 4-6.
Indiana Industrial-Education Association, Oliver Hotel, South Bend, April 4-6.
California Industrial-Education Association, Civic Auditorium, San Jose, April 5-6.
Michigan Industrial-Education Society, Grand Rapids, April 11-13.
American Industrial-Arts Association, Kansas City, Mo., April 23-26.
New York State Vocational and Practical Arts Association, Rochester, May 2-4.
North Carolina Industrial-Arts Association, Charlotte, May 2-3.
Wisconsin Association for Vocational and Adult Education, Madison, May 3-4.
Oswego Industrial-Arts Spring Conference, State Teachers College, N.Y., May 9-10.
Georgia Vocational Association, Biltmore Hotel, Atlanta, June 13-14.
International Graphic-Arts Education Association, Rochester, N.Y., July 28-Aug. 2.
American Vocational Association, Philadelphia, Pa., Aug. 5-9.

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• 1" COLLET CAPACITY
• 1¾" SPINDLE BORE
• 23" and 35" CENTERS
• VARIABLE SPEED OR DOUBLE V-BELT DRIVE

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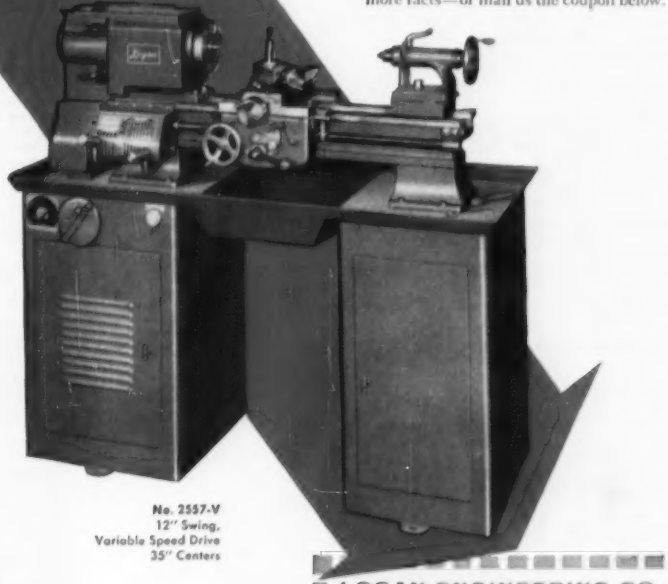
ACCURACY, CAPACITY AND POWER

This 12" swing lathe typifies Logan advanced design and rugged construction. Gears are extra wide and strong. Shafts are extra heavy. The lead screw has a full ⅞" diameter. The precision carriage rides on a two-V-way, two-flat-way bed that is rugged, precision ground and warp-free. The heavy spindle turns on oversize ball bearings, no bearing adjustment needed for any speed between 38 and 1575 rpm. This lathe, and every Logan Lathe from 14" swing down to 9" swing, is dynamically balanced before it is shipped. The result is *sustained accuracy* and smooth, quiet power on every lathe turning operation. See your Logan Lathe dealer for more facts—or mail us the coupon below.



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Suppliers Directory

For the 14th successive year, SCHOOL SHOP offers to its readers this extensive and up-to-date guide to sources of equipment and supplies needed in shop work. Listed below are the manufacturers and distributors of more than 180 classifications of products, ranging from Abrasive Paper, Cloth to Wrenches.

This year the sources of supplies are listed first under the various classifications. Following this, starting on page 86, is the alphabetical list of all the firms included in the first section. To use the directory, look under the classification first to find the suppliers of the item needed, then use the alphabetical list for the addresses of the firms.

The Suppliers Directory has proved to be one of the most popular and helpful of SCHOOL SHOP's special features. Be sure to keep this issue handy, so that when you need supplies and equipment during the coming year you will know where to write for catalogs and information. Please be sure to mention SCHOOL SHOP when writing.

ABRASIVE PAPER, CLOTH

Boin Arts & Crafts Co.
Brodhead-Garrett Co.
D. W. Cope Plastics
Craftsman Supply House
Craftsman Wood Service Co.
Delta Power Tool
DeWalt, Inc.
Dremel Mfg. Co.
General Finishes Sales & Service
Grieger's Inc.
Howard & Smith, Inc.
Kindt-Collins Co.
Montgomery Ward
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.
Sears, Roebuck & Co.
Tepping Studio Supply Co.

ABRASIVE STONES, WHEELS

Alvin Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Craftsman Supply House
Craftsman Wood Service
Delta Power Tool
DeWalt, Inc.
Dremel Mfg. Co.
Grieger's Inc.
Howard & Smith, Inc.
Machine Shop Project Service
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Patterson Bros.
Sears, Roebuck & Co.

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AIRCRAFT TOOLS

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Duro Metal Prods. Co.
Lufkin Rule Co.
Millers Falls Co.
Proto Tools
Severance Tool Industries, Inc.
L. S. Starrett Co.
J. H. Williams & Co.

AIRPLANE MODELS, SUPPLIES

Craft Service
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Chas. A. Bennett Co., Inc.
Better Light Better Sight Bureau
Crow Electri-Craft
Delco-Remy Division
DonJer Products Co.
Jam Handy Organization
Lincoln Electric Co.
Linde Air Products Co.
Lufkin Rule Co.
Magna Power Tool Corp.
McGraw-Hill Book Co.
McKnight & McKnight Publishers
Modern Engineering Co.
Hazel Pearson Handicrafts
South Bend Lathe Works
Stanley Tools
L. S. Starrett Co.
United World Films, Inc.
Walker-Turner Division
Young America Films

AUTOMOTIVE ELECTRICAL ASSEMBLIES

Brodhead-Garrett Co.
Delco-Remy Division

AUTOMOTIVE SHOP EQPT.

(See also Hand Tools, Mechanics)

Atlas Press Co.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Delta Power Tool Division
Duro Metal Products Co.
R. K. LeBlond Machine Tool Co.
Lufkin Rule Co.
Mall Tool Co.
Millers Falls Co.
National System of Garage Ventilation, Inc.
Parent Metal Products
Patterson Brothers
Proto Tool Co.
Rochester Prods.
L. S. Starrett Co.
Tolerton Co.
J. H. Williams & Co.

BENCHES, SHOP METAL OR WOOD

(See also Shop Furniture)

ABC Metal Products
American Type Founders Sales Corp.
Angle Steel Inc.
Brodhead-Garrett Co.
Challenge Machinery Co.
Craftools, Inc.
Howard & Smith, Inc.
Mayline Co.
Montgomery Ward
Parent Metal Prods. Inc.
Patterson Bros.
G. A. Pratt Co.
Sears, Roebuck & Co.
E. H. Sheldon Eqpt. Co.
South Bend Lathe Works
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BENDING MACHINES

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Dreis & Krump Mfg. Co.
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O'Neil-Irwin Mfg. Co.
Patterson Bros.
Peck, Stow & Wilcox Co.
J. A. Richards Co.
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BITS, WOODWORKING

Boice-Crane Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Chicago-Latrobe Twist Drill
Craftsman Wood Service
Delta Power Tool Division
DeWalt, Inc.
"Dowl-It" Co
Greenlee Tool Co.
Howard & Smith, Inc.
Irwin Auger Bit Co.
Mall Tool Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.
Stanley Tools
Whitman & Barnes
J. H. Williams & Co.

BLOW TORCHES

Boin Arts & Crafts
Brodhead-Garrett Co.
Grieger's Inc.
Howard & Smith, Inc.
Linde Air Products
Master Appliance Mfg. Co.
Metal Crafts Supply Co.
Modern Engineering Co.
Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.

BLUEPRINTING EQPT.

(See also Drafting Eqpt.)

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Modern School Supplies
Peck and Harvey
Frederick Post Co.
Stacor Equipment Co.

BOOKBINDING EQPT. & SUPPLIES

Challenge Machinery Co.
G. A. Pratt Co.

BOOKS

(See Publishers)

BRACES, BITS

(See also Hand Tools, Woodworking)

Brodhead-Garrett Co.
Craftsman Wood Service
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
Sears, Roebuck & Co.
Stanley-Yankee Tools

BRAZERS, BAND SAW BLADE

Boice-Crane Co.
Brodhead-Garrett Co.
Huther Bros. Saw Mfg. Co.
Kindt-Collins Co.
Oliver Machinery Co.

BUFFING LATHES

Baldor Electric Co.
Brodhead-Garrett Co.
Craftools, Inc.
Divine Bros. Co.
Jewelry Craft Supply
Patterson Bros.
Queen City Machine Tool Co.

BUFFING WHEELS & COMPOUNDS

Boin Arts & Crafts Co.
Brodhead-Garrett Co.
D. W. Cope Plastics
Craftools, Inc.
Craftsman Supply House
Delta Power Tool Div.
DeWalt, Inc.
Divine Bros. Co.
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Machine Shop Project Service
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.

BURRS

D. W. Cope Plastics
Craftsman Supply House
Foredom Electric Co.
Jewelry Craft Supply
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.
Severance Tool Industries, Inc.

CABINETS, TOOL AND STORAGE

Armstrong Bros. Tool Co.
Brodhead-Garrett Co.
Giles & Ke-dall Co.
Howard & Smith, Inc.
Montgomery Ward
Parent Metal Prods.
Patterson Bros.
Proto Tool Co.
Sears, Roebuck & Co.
E. H. Sheldon Eqpt. Co.
Standard Pressed Steel Co.
Tolerton Co.

CALIPERS

Alvin Co.
Brodhead-Garrett Co.
Brown & Sharpe
Craftsman Wood Service
Howard & Smith, Inc.
Lufkin Rule Co.
Millers Falls Co.
Modern School Supplies
Montgomery Ward
Patterson Bros. Co.
Geo. Scherr Co.
Sears, Roebuck & Co.
L. S. Starrett Co.

CANS, OIL, GASOLINE AND SAFETY

Eagle Mfg. Co.

CASTINGS—MACHINE SHOP PROJECTS

Casting Specialties Co.
Lewis Machine Tool Co.
Machine Shop Project Service
Pootatuck Corp.

CERAMIC EQUIPMENT

Bergen Arts & Crafts
Boin Arts & Crafts Co.
Brodhead-Garrett Co.
Copper Shop
Craftools, Inc.
Craft Service
Craftsman Supply House
DonJer Prods. Co.
Electric Hotpack Co., Inc.
Gagers Handicrafts
Howard & Smith
J. C. Larson Co., Inc.
Plasticast Co.
Sax Brothers, Inc.
School Prods. Co.
Seeley's Ceramic Service
Tepping Studio Supply
Thomas C. Thompson
Western Materials Co.

CERAMIC SUPPLIES

Bergen Arts & Crafts
Boin Arts & Crafts Co.
Brodhead-Garrett Co.
Craftools, Inc.
Craft Service
DonJer Products Co.
Dremel Mfg. Co.
Electric Hotpack Co.
Gagers Handicrafts
J. C. Larson & Co., Inc.
Plasticast Co.
Sax Brothers, Inc.
School Products Co.
Seeley's Ceramic Service
Tepping Studio Supply
Tolerton Co.
X-acto, Inc.

CHISELS, METALWORKING

Billings & Spencer Co.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Duro Metal Prods. Co.
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
Proto Tools
Sax Brothers, Inc.
Sears, Roebuck & Co.
Stanley Tools
J. H. Williams & Co.

CHISELS, WOODWORKING

(See also Hand Tools, Woodworking)

Boice-Crane Co.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Craft Service
Craftsman Wood Service
Delta Power Tool Div.
DeWalt, Inc.
Duro Metal Products Co.
Greenlee Tool Co.
Howard & Smith, Inc.
Millers Falls Co.
Frank Mittermeier
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
H. K. Porter Co., Henry Disston Div.
Sax Brothers, Inc.
Sears, Roebuck & Co.
Stanley Tools
Yates-American Machine Co.

CHUCKS, LATHE & MAGNETIC

Boice-Crane Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Buck Tool Co.
Casting Specialties Co.
Delta Power Tool Div.
L-W Chuck Co.
Mall Tool Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.
South Bend Lathe Works
Walker-Turner

CLAMPS, "C"

Adjustable Clamp Co.
Armstrong Brothers Tool Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Cincinnati Tool Co.
Craftsman Wood Service
Gunver Mfg. Co.
Howard & Smith, Inc.
Montgomery Ward
Patterson Bros.
Sax Brothers, Inc.
Sears, Roebuck & Co.
Wetzler Clamp Co.
J. H. Williams & Co.
Wilton Tool Mfg. Co.
X-acto, Inc.

CLAMPS, METALWORKING

Adjustable Clamp Co.
Armstrong Bros. Tool Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Cincinnati Tool Co.
Gunver Mfg. Co.
Howard & Smith, Inc.
Lufkin Rule Co.
Montgomery Ward Co.
Patterson Bros.
L. S. Starrett Co.
Upholstery Supply Co.
Wetzler Clamp Co.
J. H. Williams & Co.
Wilton Tool Mfg. Co.

CLAMPS, WOODWORKING

Adjustable Clamp Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Craftsman Wood Service
DeWalt Inc.
Gunver Mfg. Co.
Howard & Smith, Inc.
Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.
Wetzler Clamp Co.
J. H. Williams & Co.
Wilton Tool Mfg. Co.

CLEANERS, FILE

Brodhead-Garrett Co.
Cincinnati Tool Co.
Patterson Bros.
Sears, Roebuck & Co.

CLOCK MOVEMENTS

Brodhead-Garrett Co.
D. W. Cope Plastics
Plastic Products Co.
School Products Co.
Standard Electric Time
Tepping Studio Supply

COUNTERSINKS

Brodhead-Garrett Co.
Chicago-Latrobe
Millers Falls Co.
Patterson Bros.
Sears, Roebuck & Co.
Severance Tool Industries, Inc.
Stanley Tool Co.
Whitman & Barnes

CRAFT SUPPLIES

Alvin Co.
Bergen Arts & Crafts
Boin Arts & Crafts
Brodhead-Garrett Co.
Cadillac Plastic & Chemical Co.
D. W. Cope Plastics
Copper Shop
Craftools, Inc.
Craft Service
Craftsman Supply House
Craftsman Wood Service
Dearborn Leather Co.
DonJer Products Co.
Dremel Mfg. Co.
Gagers Handicrafts Co.
Gearon Co.
Gilbert & Miller, Inc.
Patterson Bros.
Sax Brothers, Inc.
Sears, Roebuck & Co.
Wetzler Clamp Co.
J. H. Williams & Co.
Wilton Tool Mfg. Co.
X-acto, Inc.

Giles & Kendall Co.
Gyro Lamp & Shade Corp.
House of Plastics
Jewelry Craft Supply
Kit Kraft
J. C. Larson Co.
Metal Crafts Supply Co.
Metal Goods Corp.
Metal Supply, Inc.
Millers Falls Co.
Minnesota Woodworkers Supply
Frank Mittermeier
Modern School Supplies
R. Murphy Co.
Hazel Pearson Handicrafts
Plasticast Co.
Plastic Parts & Sales Co.
Plastic Products Co.
G. A. Pratt Co.
Red Devil Tools
Sax Brothers, Inc.
School Products Co.
Upholstery Supply Co.
Webcraft, Inc.
X-acto, Inc.

CUTTERS, PAPER

Alvin Co.
Brodhead-Garrett Co.
Challenge Machinery Co.
Pioneer-Toledo Corp.
Sax Bros., Inc.

CUTTING TOOLS, MACHINE SHOP

Armstrong Brothers Tool Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Delta Power Tool Div.
DeWalt, Inc.
Howard & Smith, Inc.
Huther Bros. Saw Mfg. Co.
Kearney & Tracker
R. K. LeBlond Machine Tool Co.
Logan Engineering Co.
Mico Instrument Co.
Millers Falls Co.
Patterson Bros.
Peck, Stow & Wilcox Co.
Sears, Roebuck & Co.
Severance Tool Ind., Inc.
South Bend Lathe Works
Whitman & Barnes
J. H. Williams & Co.

DIVIDERS

Alvin Co.
Berger Scientific Supplies
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Burstein-Applebee Co.
Gramercy Guild Group, Inc.
Keuffel & Esser
Lufkin Rule Co.
Millers Falls Co.
Modern School Supplies
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
Frederick Post Co.
Sears, Roebuck & Co.
Stanley Tools
L. S. Starrett Co.
V & E Manufacturing Co.

DIVIDING HEADS

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Greaves Machine Tool Co.
Lewis Machine Tool Co.
L-W Chuck Co.
Patterson Bros.

DOWEL DRILL GUIDE

Brodhead-Garrett Co.
Craftsman Wood Service "Dowl-It" Co.
Gunver Mfg. Co., Inc.
Patterson Bros.

DOWELS

Brodhead-Garrett Co.
Cotton-Hanlon, Inc.
Craft Service
Craftsman Wood Service "Dowl-It" Co.
T. A. Foley Lumber Co.
Kindt-Collins Co.
Patterson Bros.
Frank Paxton Lumber Co.

DRAFTING EQPT.

Adjusto Eqpt. Co.
Alvin Co.
Angle Steel Inc.
Berger Scientific Supplies, Inc.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Gramercy Guild Group, Inc.
Howard & Smith
Keuffel & Esser
Lufkin Rule Co.
Mayline Co.
Modern School Supplies
Parent Metal Products, Inc.
Frederick Post Co.
Stacor Equipment Co.
Universal Drafting Machine Corp.
V & E Manufacturing Co.

DRAFTING FURNITURE

Alvin Co.
Brodhead-Garrett Co.
Keuffel & Esser Co.
Mayline Co.
Modern School Supplies
Parent Metal Products, Inc.
Frederick Post Co.
Stacor Equipment Co.
Standard Pressed Steel Co.
Tolerton Co.

DRAFTING SUPPLIES

Alvin Co.
Berger Scientific Supplies, Inc.
Boin Arts & Crafts
Brodhead-Garrett Co.
Eagle Pencil Co.
Gramercy Guild Group, Inc.
Higgins Ink Co., Inc.
Keuffel & Esser
Mayline Co.
Modern School Supplies
Frederick Post Co.
School Products Co.
Stacor Equipment Co.
Universal Drafting Machine Corp.
V & E Manufacturing Co.

DRILL PRESSES

Boice-Crane Co.
Brodhead-Garrett Co.
Cincinnati Lathe & Tool Co.
Clausing Div., Atlas Press
Delta Power Tool Division
DeWalt, Inc.
Duro Metal Products Co.
Howard & Smith, Inc.
Lewis Machine Tool Co.
Magna Power Tool Corp.
Mico Instrument Co.
Montgomery Ward
Patterson Bros.
J. A. Richards Co.
School Products Co.
Sears, Roebuck & Co.
South Bend Lathe Works
Walker-Turner Div.

DRILLS, CARVING FOR PLASTICS

Boin Arts & Crafts Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
D. W. Cope Plastics
Craft Service
Craftsman Supply House
Foredom Electric Co.
House of Plastics
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.

DRILLS, HAND

(See also Hand Tools)

Allied Radio Corp.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Craftsman Wood Service
Foredom Electric Co.
Howard & Smith, Inc.
Metal Crafts Supply Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
Plastic Products Co.
G. A. Pratt Co.
Proto Tool Co.
Sears, Roebuck & Co.
Stanley-Yankee Tools
X-acto, Inc.

DRILLS, PAPER

Challenge Machinery Co.
Pioneer-Toledo Corp.

DRILLS, PORTABLE ELECTRIC

(See also Portable Electric Tools)

Allied Radio Corp.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Casting Specialties Co.
Cincinnati Tool Co.
D. W. Cope Plastics
Craft Service
Craftsman Wood Service
Howard & Smith, Inc.
Mall Tool Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.
Proto Tools
Sears, Roebuck & Co.
Skil Corp.
Stanley Electric Tools

DRILLS, TWIST

Brodhead-Garrett Co.
Burstein-Applebee Co.
Chicago-Latrobe
D. W. Cope Plastics
Craftsman Wood Service
Delta Power Tool
"Dowl-It" Co.
Howard & Smith, Inc.
Mall Tool Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Plastic Parts & Sales
Plastic Products Co.
Sears, Roebuck & Co.
Whitman & Barnes
X-acto, Inc.

DUST COLLECTORS

American Air Filter Co.
Brodhead-Garrett Co.
Craftools, Inc.
Delta Power Tool
Kindt-Collins Co.
Ohio Blow Pipe Co.
Patterson Bros.
School Products Co.
Torit Mfg. Co.

ELECTRIC EQUIPMENT AND SUPPLIES

(See also Radio Eqpt.)

Allied Radio Corp.
Brodhead-Garrett Co.
Burstein-Applebee
Crow Electri-Craft
Electronic Inst. Co.
Gearon Co.
Gyro Lamp & Shade Corp.
Heath Co.
L. H. Kassell & Co.
Montgomery Ward
National Adequate Wiring Bureau
Ohmite Mfg. Co.
Parent Metal Products, Inc.
Park Magnets
Patterson Brothers
Science Electronics
Standard Electric Time Co.
Telephone Engineering Co.
Tolerton Co.

ELECTRIC MOTORS

(See Motors)

ELECTRONIC EQPT.

(See also Radio Eqpt.)

Allied Radio Corp.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Burstein-Applebee
Crow Electri-Craft
Electronic Instrument Co.
Heath Company
Ohmite Mfg. Co.
Science Electronics
Standard Electric Time Co.
Triple Cities R.C. Supply Co.

ENAMELING SUPPLIES, AND EQUIPMENT

Bergen Arts & Crafts
Boin Arts & Crafts Co.
Brodhead-Garrett Co.
The Copper Shop
Craftools, Inc.
Craft Service
Craftsman Supply House
Dearborn Leather Co.
Electric Hotpack Co., Inc.
Gagers Handicraft
Grieger's Inc.
Kit Kraft
J. C. Larson Co.
Metal Crafts Supply Co.

NAME	LUFKIN
ACCURACY	A
DURABILITY	a
CONVENIENCE	A
READABILITY	A
FINISH	a
BALANCE	A

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Precision Tools
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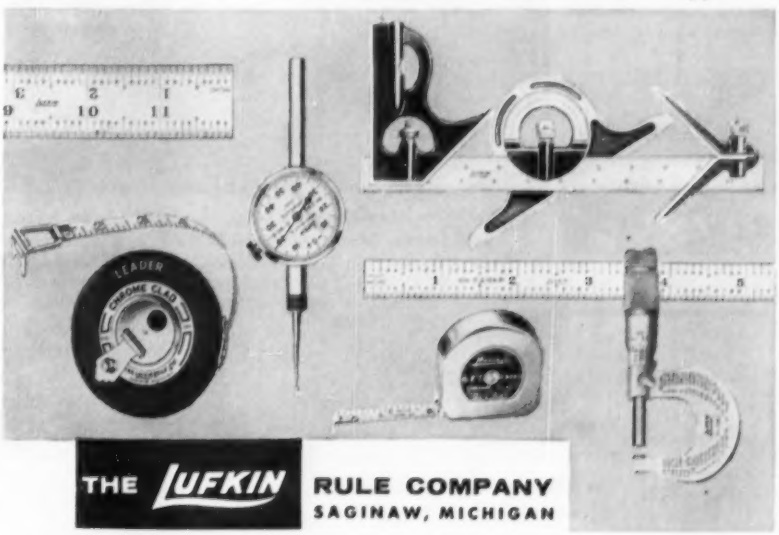


THE LUFKIN RULE COMPANY
SAGINAW, MICHIGAN

Plasticast Co.
Sax Brothers, Inc.
School Products Co.
Seeley's Ceramic Service
Tepping Studio Supply
Thomas C. Thompson Co.
Western Materials Co.

EXTRACTORS, PIPE, STUD, SCREW, TAP

Brodhead-Garrett Co.
Patterson Bros.
Proto Tool Co.
Whitman & Barnes
J. H. Williams & Co.

FIBERGLASS
(See Plastics)

FILES, HAND

Brodhead-Garrett Co.
Craftsman Supply House
Craftsman Wood Service
Grieger's Inc.
Howard & Smith, Inc.
Metal Crafts Supply Co.
Frank Mittermeier
Montgomery Ward
Patterson Bros.
Fayette R. Plumb
H. K. Porter Co., Henry Disston Div.
Proto Tools
Sales Service Machine Tool Co.
Sax Bros., Inc.
Sears, Roebuck & Co.
Severance Tool Ind., Inc.
X-acto, Inc.

FILES, ROTARY

Frank Mittermeier
H. K. Porter Co., Henry Disston Div.
Severance Tool Ind., Inc.

FILING MACHINES

Boice-Crane Co.
Foley Mfg. Co.
Howard & Smith, Inc.
Sales Service Machine Tool Co.

FINDINGS, METAL

Boin Arts & Crafts Co.
Brodhead-Garrett Co.
D. W. Cope Plastics
Copper Shop
Craft Service
Craftsman Supply House
Grieger's Inc.
House of Plastics
Jewelry Craft Supply
J. C. Larson Co.
Metal Crafts Supply Co.
Plasticast Co.
Plastic Parts & Sales
Plastic Products Co.
Sax Brothers, Inc.
School Products Co.
Tepping Studio Supply

FLEXIBLE SHAFT MACHINES

Boin Arts & Crafts Co.
Brodhead-Garrett Co.
D. W. Cope Plastics
Dremel Mfg. Co.
Foredom Electric Co.
House of Plastics
Mall Tool Co.
Montgomery Ward
Patterson Bros.
Plastic Parts & Sales
Plastic Prods. Co.
Sears, Roebuck & Co.
Walker-Turner Div.

FORGES

Billings & Spencer Co.
Brodhead-Garrett Co.
McEnglevan Heat Treating & Mfg. Co.
Patterson Bros.
Western Materials Co.

FORGE TOOLS

Brodhead-Garrett Co.
Cincinnati Tool Co.
Howard & Smith, Inc.
Millers Falls Co.
Patterson Bros.
Stanley Tools

FOUNDRY EQPT.

Brodhead-Garrett Co.
Delta Power Tool Div.
DeWalt, Inc.
Howard & Smith, Inc.
McEnglevan Heat Treating & Mfg. Co.
Patterson Bros.
Standard Pressed Steel Co.
Tolerton Co.
Western Materials Co.

FURNACES, SHOP
(Forge, Heat Treating)

Brodhead-Garrett Co.
Electric Hotpack Co., Inc.
Howard & Smith, Inc.
McEnglevan Heat Treating & Mfg. Co.
Patterson Bros.
Western Materials Co.

FURNITURE
(See Shop Furniture)

GAGES, METALWORKING

Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Howard & Smith, Inc.
Lufkin Rule Co.
Millers Falls Co.
Patterson Bros.
Sax Brothers Co.
Geo. Scherr Co.
Sears, Roebuck & Co.
L. S. Starrett Co.

GAGES, WOODWORKING

Alvin Co.
Brodhead-Garrett Co.
Craftsman Wood Service
Howard & Smith, Inc.
Lufkin Rule Co.
Magna-Set Co.
Millers Falls Co.
Patterson Bros.
Stanley Tools
L. S. Starrett Co.

GLUE POTS

Brodhead-Garrett Co.
Divine Bros. Co.
Electric Hotpack Co.
Howard & Smith, Inc.
Kindt-Collins Co.
Oliver Machinery Co.
Patterson Bros.
G. A. Pratt Co.

GLUES, CEMENTS

Boin Arts & Crafts Co.
Borden Co.
Brodhead-Garrett Co.
Cadillac Plastic Co.
D. W. Cope Plastics
Craft Service
Craftsman Supply House
Craftsman Wood Service
Divine Bros. Co.
DonJer Products Co.
Giles & Kendall Co.
Higgins Ink Co.
Howard & Smith, Inc.
Kindt-Collins Co.
J. C. Larson Co.
Minnesota Woodworkers Supply Co.
Modern School Supplies
Monite Waterproof Glue Co.
Patterson Bros.
Frank Paxton Lumber Co.
Plasticast Co.
Plastic Parts & Sales
Plastic Products Co.
Frederick Post Co.
Rogers Isinglass & Glue Co.
Sax Brothers Co.
U. S. Plywood Corp.

GRINDERS, CENTERLESS

Cincinnati Milling Machine Co.

GRINDERS, PORTABLE ELECTRIC

Brodhead-Garrett Co.
Burstein-Applebee Co.
D. W. Cope, Plastics
Craft Service
Foredom Electric Co.
Dremel Mfg. Co.
Mall Tool Co.
Master Appliance Mfg. Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Plastic Parts & Sales
Plastic Products
Skil Corp.
Stanley Electric Tools

GRINDERS, PRODUCTION, SURFACE

Brodhead-Garrett Co.
Brown & Sharpe
Cincinnati Milling Machine Co.
Delta Power Tool
Patterson Bros.

GRINDERS, TOOL
(See also Grinders, Portable; Grinders, Toolpost)

Baldor Electric Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Brown & Sharpe
Cincinnati Milling Machine Co.
Clausing Div., Atlas Press
Craftools, Inc.
Craftsman Wood Service
Delta Power Tool Division
DeWalt, Inc.
Howard & Smith, Inc.
Kearney & Trecker
R. K. LeBlond Machine Tool Co.
Machine Shop Project Service
Mico Instrument Co.
Millers Falls Co.
Oliver Machinery Co.
Patterson Bros.
Queen City Machine Tool Co.
Sears, Roebuck & Co.
Skil Corp.
South Bend Lathe Works
Stanley Electric Tools
Stanley Tools
Walker-Turner Div.

GRINDERS, TOOLPOST

Brodhead-Garrett Co.
Clausing Div., Atlas Press
Montgomery Ward
Patterson Bros.
South Bend Lathe Works
Stanley Tools

GUARDS
(See Safety Equipment)

HACKSAWS, HAND
(See also Hand Tools)

Allied Radio Corp.
Brodhead-Garrett Co.
Duro Metal Products Co.
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
H. K. Porter Co., Henry Disston Div.
G. A. Pratt Co.
Proto Tools
Sears, Roebuck Co.
L. S. Starrett Co.

HACKSAWS, POWER

Brodhead-Garrett Co.
Howard & Smith, Inc.
Lewis Machine Tool Co.
L-W Chuck Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
H. K. Porter Co., Henry Disston Div.
G. A. Pratt Co.
Sales Service & Machine Tool
Sears, Roebuck & Co.
L. S. Starrett Co.

HAMMERS, METALWORKING

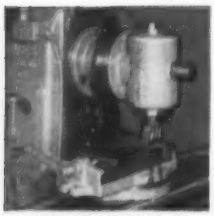
Armstrong Bros. Tool Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Casting Specialties Co.
Duro Metal Products Co.
Howard & Smith, Inc.
Metal Crafts Supply
Patterson Bros.
Peck, Stow & Wilcox Co.
Fayette R. Plumb
Proto Tools
Sax Brothers Co.
Sears, Roebuck & Co.
Stanley Tools
J. H. Williams & Co.

HAMMERS, WOODWORKING

Brodhead-Garrett Co.
Craftsman Wood Service
Duro Metal Products Co.
Estwing Mfg. Co.
Howard & Smith, Inc.
Millers Falls Co.
Patterson Bros.
Peck, Stow & Wilcox Co.
Fayette R. Plumb
Sears, Roebuck & Co.
Stanley Tools

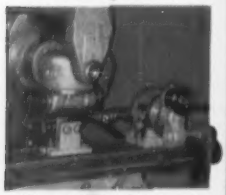
HAND TOOLS, MACHINE SHOP
(See also Hand Tools, Mechanics)

Allied Radio Corp.

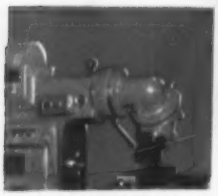


Heavy Duty Vertical Milling Attachment

Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment



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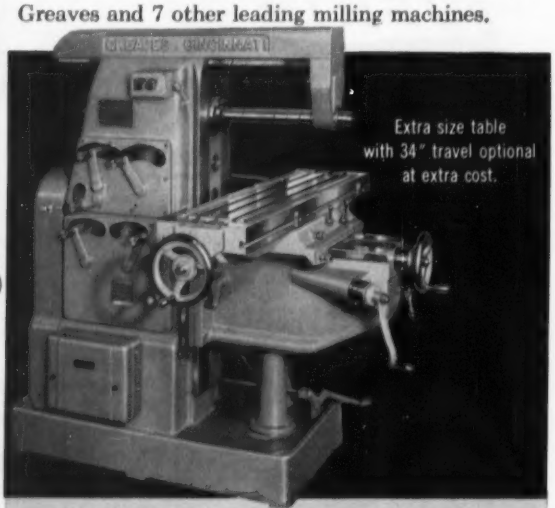

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Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.
Send information on Attachments and Accessories for GREAVES MILLS.

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FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

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BENCH TOPS
of any size, in genuine TOLCO quality
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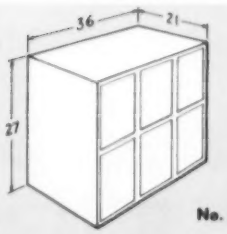
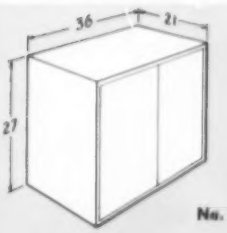
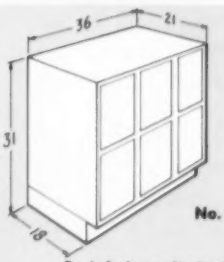
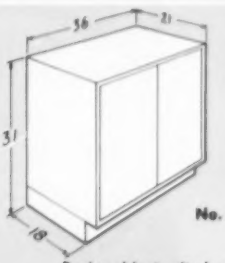
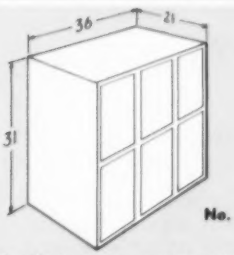
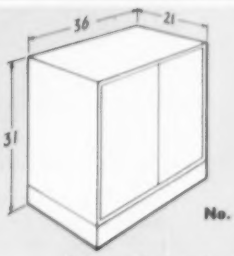
all-steel lockers or cabinets in two colors
BENCH RISERS
to make up toe-recessed or flush-front assemblies

Typical wall bench, using the new H&S toe-recess locker (No. 6T).

LOCKER TYPE	CABINET TYPE
 No. 6E	 No. 2E
Basic locker unit for elementary and junior high use, 27" high	Basic cabinet unit for elementary and junior high use, 27" high
 No. 6T	 No. 2T
Basic locker unit plus toe-recessed riser, 31" high	Basic cabinet unit plus toe-recessed riser, 31" high.
 No. 6	 No. 2
Higher locker unit, roomier lockers 31" high, for High School and College	Basic cabinet unit plus flush-front riser, 31" high

The basic locker and cabinet units are of identical overall dimensions, to allow their combination in forming various assemblies. While the basic locker units contain six lockers, they can be unbolted to form three smaller two-locker units, thus increasing their flexibility.

The basic units plus 2¼" thick tops form ideal working heights for elementary and junior high school students. Older (and taller) students are accommodated by the addition of a 4" riser. This may be of the flush-front type where tops extend out sufficiently, or of the toe-recessed type where they do not. This toe-recessed riser, unique with H & S units, prevents needless damage to locker and cabinet doors and provides a more comfortable working position for the student.

Genuine TOLCO bench tops are supplied in any width, length, or thickness that is required. TOLCO tops are constructed of ¾" wide full length strips of northern hard maple. They are electronically glued and strengthened by concealed steel tie rods. Lacquered, galvanized steel, or acid resistant surfaces may be had.

See other side for typical H&S shop benches

Shop, Laboratory, and Art Benches

These standard assemblies all utilize H&S Shop Bench Units, Tops, and Risers. Single, two, four, or six student work benches, and island base and wall type assemblies may be made by using these same components. Many standard assemblies other than those shown here have been worked out and are sold as complete units. However, the flexibility of the basic units permit an infinite number of variations.

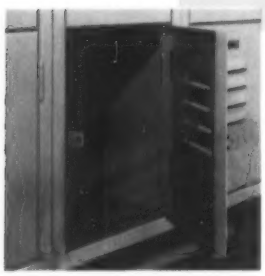
Model T-64, senior height four-student bench.

Model T-62E, junior height two-student bench.

Model T-21T, senior height one-student bench.

Model TIS-64E, junior height four-student crafts bench.

Model TWC-10T, wall bench using toe-recess lockers (No. 6T) and toe-recess cabinet (No. 2T).



Quality Features Found on All H&S Shop Bench Units

LOCKER TYPE

Locker doors are ventilated and provided with sturdy friction-closure padlock catches. They don't rebound when slammed shut. Heavy hinges withstand long hard use. Locker bottoms are flush with sills to allow easy sweeping out. Each 2-locker section is of welded heavy gauge steel, with baked enamel finish.

CABINET TYPE

A heavy gauge steel unit. Cabinet doors have a heavy satin chromed lock for safe storage of supplies. Cabinet shelves are fully adjustable, to suit your needs. Additional shelves may be added. Both cabinet and locker type units are available in two colors: Castillian Green or Light Cadet Grey.

Howard and Smith, inc.

WRITE TODAY for a complete illustrated price list, covering all the standard H & S work benches. Prices also given for the H & S work bench units, risers, and TOLCO tops so that you can plan the assembly of benches to suit your own needs.

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This looks like a conventional universal scroll chuck—but it's much more than that. It is the *first* substantial improvement in scroll chucks *in the past 50 years*—and is now widely used in industry.

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Keuffel & Esser
Lufkin Rule Co.
Millers Falls Co.
Modern School Supplies
Montgomery Ward
Patterson Bros.
H. K. Porter Co., Henry Disston Div.
Frederick Post Co.
Sears, Roebuck & Co.
Stanley Tools
L. S. Starrett Co.
Universal Drafting Machine Corp.
Upholstery Supply Co.

SAFETY EQUIPMENT
Brett-Guard Company
Brodhead-Garrett Co.
D & M Guard
Eagle Mfg. Co.
Howard & Smith, Inc.
King Mfg. Co.
Mall Tool Co.
Stanley Electric Tools
U.S. Safety Service Co.
Watchemoket Optical Co.
Western Materials Co.

SAFETY FLOOR COVERINGS
American Abrasive Metals Co.

SANDERS AND SURFACERS
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Brodhead-Garrett Co.
Burstein-Applebee Co.
Clausing Div., Atlas Press
Delta Power Tool Div.
DeWalt, Inc.
Dremel Mfg. Co.
Duro Metal Products Co.
Enterprise Co.
J. A. Fay & Egan Co.
Greenlee Bros. & Co.
Howard & Smith, Inc.
Kindt-Collins Co.
Millers Falls Co.
Montgomery Ward
Oliver Machinery Co.
Parks Woodworking Machine Co.
Patterson Bros.
Red Devil Tools
Sears, Roebuck & Co.
Skil Corp.
Stanley Electric Tools
Walker-Turner Division
Yates-American Machine Co.

SAW BLADES, BAND
Boice-Crane Co.
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Delta Power Tool Division
Duro Metal Products Co.
Heinemann Saw Corp.
Howard & Smith, Inc.
Huther Bros. Saw Mfg. Co.
Millers Falls Co.
Montgomery Ward
Oliver Machinery Co.
Parks Woodworking Machine Co.
Patterson Bros.
H. K. Porter Co., Henry Disston Div.
Sears, Roebuck & Co.
L. S. Starrett Co.
Walker-Turner Division
Wells Manufacturing Co.
Yates-American Machine Co.

SAW BLADES, CIRCULAR
Boice-Crane Co.
Brodhead-Garrett Co.
D. W. Cope Plastics
Craftsman Wood Service
Delta Power Tool Division
DeWalt, Inc.
Duro Metal Products Co.
Heinemann Saw Corp.
House of Plastics
Howard & Smith, Inc.
Huther Bros. Saw Mfg. Co.
Magna Power Tool Corp.
Mall Tool Co.
Montgomery Ward
Oliver Machinery Co.
Patterson Bros.
Plastic Products Co.
H. K. Porter Co., Henry Disston Div.
Rocco Prods., Inc.
Sears, Roebuck & Co.
Stanley Electric Tools
Walker-Turner Division
Yates-American Machine Co.

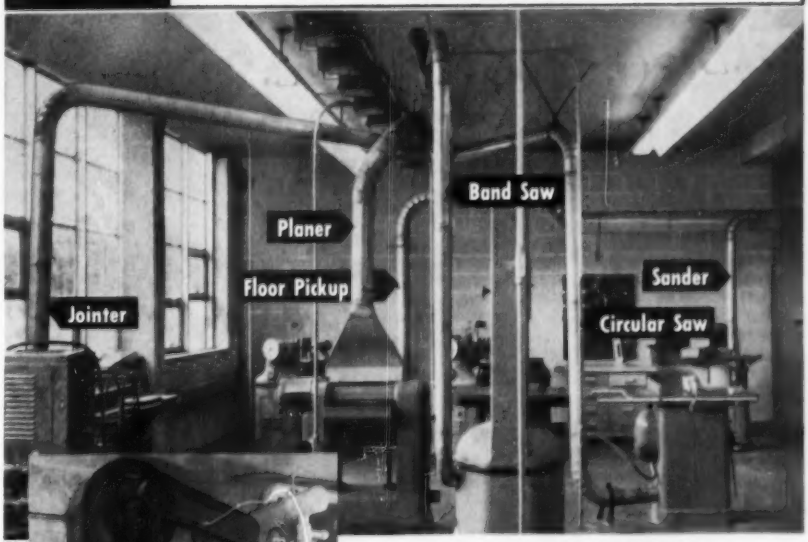
SAW BLADES, METAL CUTTING
Alvin Co.
Boice-Crane Co.
Boin Arts & Crafts Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Craft Service
Delta Power Tool Division
DeWalt, Inc.
Heinemann Saw Corp.
Huther Bros. Saw Mfg. Co.
Metal Crafts Supply Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
H. K. Porter Co., Henry Disston Div.
Proto Tools
Sax Brothers, Inc.
L. S. Starrett Co.
Walker-Turner Division
Wells Manufacturing Co.
Yates-American Machine Co.

SAW BLADES, SCROLL
Boice-Crane Co.
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Delta Power Tool Division
DeWalt, Inc.
Dremel Mfg. Co.
Duro Metal Products Co.
House of Plastics
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.
Walker-Turner Division

SAW FILERS, AUTOMATIC
Foley Mfg. Co.
Howard & Smith, Inc.
Huther Bros. Saw Mfg. Co.
Quick Way Saw Co.

SAWS, HAND, WOODWORKING
Alvin Co.
Brodhead-Garrett Co.

OBP ENGINEERED DUST CONTROL SYSTEMS FOR SCHOOL SHOPS



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Before you build a new shop, let Ohio Blow show you the latest engineering advances in modern, custom designed integrated systems—or if you plan to modernize or expand your present shop, ask an Ohio Blow Pipe Engineer to survey your dust collection requirements and give you a cost estimate.

This combination filter-collector is located in the storage room, completely isolated from the working area of the shop. The use of filter bags in this collector permits all heat to be retained in the building.

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Boice-Crane Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Craftsman Wood Service Co.
Delta Power Tool Division
DeWalt, Inc.
Dremel Mfg. Co.
Duro Metal Products Co.
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Millers Falls Co.
Montgomery Ward
Oliver Machinery Co.
Patterson Bros.

Plastic Products Co.
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Walker-Turner Division
X-acto Inc.

SAWS, METALCUTTING, BAND

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Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Burstein-Applebee Co.
Delta Power Tool Division
Duro Metal Prods. Co.
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Oliver Machinery Co.
Patterson Bros.
L. S. Starrett Co.
Walker-Turner Division
Wells Manufacturing Co.

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Burstein-Applebee Co.
DeWalt, Inc.
Dremel Mfg. Co.
Howard & Smith, Inc.
Mall Tool Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Plastic Products Co.
Sears, Roebuck & Co.
Skil Corp.
Stanley Electric Tools

SAWS, SCROLL, WOODWORKING

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Boice-Crane Co.
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Delta Power Tool Division
DeWalt, Inc.
Duro Metal Products Co.
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Oliver Machinery Co.
Patterson Bros.

Sears, Roebuck & Co.
Walker-Turner Division
Yates-American Machine Co.

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Brodhead-Garrett Co.
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Duro Metal Products Co.
Enterprise Co.
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Howard & Smith, Inc.
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Enterprise Co.
J. A. Fay & Egan Co.
Greenlee Bros. & Co.
Howard & Smith, Inc.
Kindt-Collins Co.
Lewis Machine Tool Co.
Magna Power Tool Corp.
Millers Falls Co.
Montgomery Ward
Northfield Foundry & Machine Co.
Parks Woodworking Machine Co.
Patterson Bros.
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J. A. Richards Co.
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Sears, Roebuck & Co.
Walker-Turner Division
Yates-American Machine Co.

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Lufkin Rule Co.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
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Sears, Roebuck & Co.
Stanley Tools
Stanley-Yankee Tools
L. S. Starrett Co.
J. H. Williams & Co.

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Mall Tool Co.
Millers Falls Co.
Patterson Bros.
Skil Corp.
Stanley Electric Tools

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(See Lathes, Turret)

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Logan Engineering Co.
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Sales Service Machine Tool
Sheldon Machine Co.
South Bend Lathe Works
J. H. Williams & Co.

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Brodhead-Garrett Co.
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Duro Metal Products Co.
Enterprise Co.
J. A. Fay & Egan Co.
Greenlee Bros. & Co.
Howard & Smith, Inc.
Lewis Machine Tool Co.
Mall Tool Co.
Montgomery Ward
Northfield Foundry & Machine Co.
Oliver Machinery Co.
Patterson Bros.
Sears, Roebuck & Co.
Skil Corp.

Stanley Electric Tools
Walker-Turner Division
Yates-American Machine Co.

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Patterson Bros.
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J. A. Richards Co.
Standard Pressed Steel Co.
Tolerton Co.
Wetzler Clamp Co.

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Metal Goods Corp.

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Craftsman Wood Service Co.
Modern School Supplies
School Products Co.

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Alvin Co.
Angle Steel Inc.
Brodhead-Garrett Co.
Can-Pro Corp.
Craftools Inc.
Federal Hardware Prods., Inc.
Hollaender Mfg. Co.
Howard & Smith, Inc.
Mayline Co.
Modern School Supplies
Parent Metal Prods., Inc.
Patterson Bros.
School Products Co.
E. H. Sheldon Eqpt. Co.
Stacor Equipment Co.
Standard Pressed Steel Co.
Tolerton Co.

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Brodhead-Garrett Co.
Burstein-Applebee Co.
Howard & Smith, Inc.
Patterson Bros.
Peck, Stow & Wilcox Co.
Proto Tool Co.
Sears, Roebuck & Co.

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Brodhead-Garrett Co.
Burstein-Applebee Co.
Grieger's Inc.
Howard & Smith, Inc.
Linde Air Prods. Co.
Metal Crafts Supply Co.
Modern Engineering Co.
Montgomery Ward
Patterson Bros.
Sax Brothers, Inc.
Sears, Roebuck & Co.
Stanley Tools
Tolerton Co.

SOLDERS AND FLUXES

Allied Radio Corp.
Boin Arts & Crafts Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Cerro de Pasco Sales Corp.
Grieger's Inc.
Howard & Smith, Inc.
Linde Air Prods. Co.
Metal Crafts Supply Co.
Mico Instrument Co.
Modern Engineering Co.
Montgomery Ward
Patterson Bros.
Sax Brothers, Inc.
Sears, Roebuck & Co.

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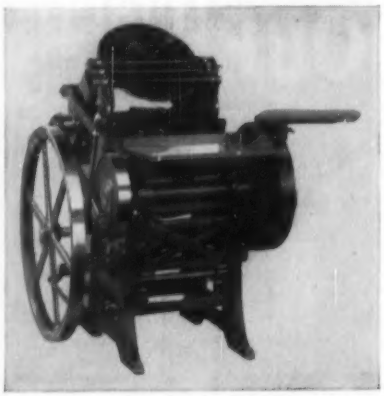

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Patterson Bros.
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Peck, Stow & Wilcox Co.
Sears, Roebuck & Co.
Stanley Tools
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Brodhead-Garrett Co.
Craftools, Inc.
Grieger's Inc.

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(See Planers, Sanders)

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Burstein-Applebee Co.
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L. S. Starrett Co.
Stanley Tools

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Burstein-Applebee Co.
Howard & Smith, Inc.
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Montgomery Ward
Patterson Bros.
Sears, Roebuck & Co.

TEACHING AIDS

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Linde Air Products
National Adequate Wiring Bureau
Rochester Products

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Southern Teachers Agency

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Burstein-Applebee Co.
Electric Hotpack Co., Inc.
Electronic Instrument Co.
Lufkin Rule Co.
Mico Instrument Co.
Standard Electric Time Co.
L. S. Starrett Co.
Weston Electrical Inst. Corp.

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Armstrong Bros. Tool Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Casting Specialties Co.
Delta Power Tool Division
Patterson Bros.
Howard & Smith, Inc.
Sheldon Machine Co.
South Bend Lathe Works
J. H. Williams & Co.

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Imperial Brass Mfg. Co.
Proto Tool Co.

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Burstein-Applebee Co.
Craft Service
Grieger's Inc.
Patterson Bros.
Sears, Roebuck & Co.
X-acto, Inc.

UNIVERSITY & COLLEGE SUMMER SESSIONS

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New York Univ.
Oregon State College
Oswego Teachers College
Penn. State Univ.
Stout State College
Wayne State Univ.

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Craftsman Wood Service
Webcraft, Inc.
Upholstery Supply Co.

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American Air Filter Co.
National System Garage Vent.
Ohio Blow Pipe Co.
Paasche Airbrush Co.

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Abernathy Vise & Tool Co.
Armstrong Bros. Tool Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Brown & Sharpe Mfg. Co.
Casting Specialties Co.
Cincinnati Milling Co.
Columbian Vise & Mfg. Co.
Delta Power Tool Div.
Desmond-Stephan Mfg. Co.
DeWalt, Inc.
Foredom Electric Co.
Greaves Machine Tool Co.
Howard & Smith, Inc.
Kearney & Tracker
Lewis Machine Tool Co.
Lufkin Rule Co.
L-W Chuck Co.
Millers Falls Co.
Montgomery Ward
Morgan Vise Co.
Parent Metal Prods.
Patterson Bros.
Sales Service Machine Tool
Sears, Roebuck & Co.
Sheldon Machine Co.
Stanley-Yankee Tools
Tolerton Co.
Wilton Tool Mfg. Co.

VISES, WOODWORKING

Abernathy Vise & Tool Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Columbian Vise & Mfg Co.
Craftsman Wood Service
Desmond-Stephan Mfg. Co.
DeWalt Inc.
Howard & Smith, Inc.
Kindt-Collins Co.
Lewis Machine Tool Co.
L-W Chuck Co.
Machine Shop Project Service
Millers Falls Co.
Montgomery Ward
Morgan Vise Co.
Oliver Machinery Co.
Parent Metal Prods.
Patterson Bros.
Sears, Roebuck & Co.
Stanley Tools
Tolerton Co.
Wilton Tool Mfg. Co.

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Brodhead-Garrett Co.
Essay Mfg. Co.
Greenlee Tool Co.
Howard & Smith, Inc.
Lincoln Electric Co.
Linde Air Prods. Co.
Marquette Mfg. Co.
Modern Engineering Co.
Montgomery Ward
Patterson Brothers
Sears, Roebuck & Co.
Standard Pressed Steel Co.
Wetzler Clamp Co.

WELDING EQUIPMENT, GAS

Brodhead-Garrett Co.
Howard & Smith, Inc.
Lincoln Electric Co.
Linde Air Products Co.
Modern Engineering Co.
Montgomery Ward
Patterson Brothers
Sears, Roebuck & Co.
Standard Pressed Steel Co.

WOODSHOP SUPPLIES
(See also Item wanted)

Alvin Co.
Brodhead-Garrett Co.
Cincinnati Tool Co.
Craftools Inc.
Craftsman Wood Service Co.
DonJer Products Co.
"Dowl-It" Co.
Estwing Mfg. Co.
General Finishes Sales & Service
Giles & Kendall Co.
Gunver Mfg. Co.
Howard & Smith, Inc.
Kindt-Collins Co.
Lufkin Rule Co.
Millers Falls Co.
Minnesota Woodworkers Supply Co.
Montgomery Ward
Patterson Brothers
Frank Paxton Lumber Co.
Red Devil Tools
Rogers Isinglass & Glue Co.
Sears, Roebuck & Co.
Southern Screw Co.
Upholstery Supply Co.
Wetzler Clamp Co.

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(See also Item wanted)

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Atlas Press Co.
Boice-Crane Co.
Brett-Guard Company
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Delta Power Tool Div.
DeWalt Co.
DonJer Products Co.
"Dowl-It" Co.
Duro Metal Products Co.
Enterprise Co.
J. A. Fay & Egan Co.
Federal Hardware Prods., Inc.
Giles & Kendall Co.
Greenlee Bros. & Co.
Gunver Mfg. Co.
Howard & Smith, Inc.
Kindt-Collins Co.
King Mfg. Co.
Lewis Machine Tool Co.
Magna Power Tool Corp.
Magna-Set Co.
Mayline Co.
Millers Falls Co.
Minnesota Woodworkers Supply Co.
Frank Mittermeier
Montgomery Ward
Morgan Vise Co.
Northfield Foundry & Machine Co.
Oliver Machinery Co.
Parent Metal Products Inc.
Parks Woodworking Machine Co.
Patterson Brothers
Pootatuck Corp.
Powermatic Machine Co.
Red Devil Tools
Sears Roebuck & Co.
Standard Pressed Steel Co.
Stanley Tools
Tolerton Co.
Walker-Turner Division
Wetzler Clamp Co.
Wilton Tool Mfg. Co.
X-acto, Inc.
Yates-American Machine Co.

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Craftsman Wood Service
DonJer Products Co.
Giles & Kendall Co.
Millers Falls Co.
Stacor Equipment Co.

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Armstrong Brothers Tool Co.
Billings & Spencer Co.
Brodhead-Garrett Co.
Burstein-Applebee Co.
Duro Metal Products Co.
Howard & Smith, Inc.
Millers Falls Co.
Montgomery Ward
Patterson Bros.
Peck, Stow & Wilcox Co.
Proto Tools
Sears, Roebuck & Co.
P. A. Sturtevant Co.
J. H. Williams & Co.

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Duro Metal Products Co.
Patterson Bros.
Proto Tools
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Chicago, Ill.

Ajusto Eqpt. Co.
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Bowling Green, Ohio

Allied Radio Corp.
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Chicago 80, Ill.

Aluminum Co. of America
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Pittsburgh 19, Pa.

Alvin Company
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Windsor, Conn.

American Abrasive Metals Co.
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Irvington, N.J.

American Air Filter Co., Inc.
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American Elec. Heater Co.
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Detroit 2, Mich.

American Machine & Foundry Co.
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American Technical Society
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Chicago 37, Ill.

American Type Founders
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Armstrong Bros. Tool Co.
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Roxbury,
Boston 19, Mass.

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Burbank, Calif.

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Hartford 1, Conn.

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Toledo 6, Ohio

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Morristown, N.J.

Borden Company Chemical Division
350 Madison Ave.
New York 17, N.Y.

Brett-Guard Co.
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Cleveland 5, Ohio

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Brunner Mfg. Co.
1821 Broad St.
Utica 1, N.Y.

Buck Tool Co.
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Kalamazoo, Mich.

Burstein-Applebee Co.
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Kansas City 6, Mo.

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15111 Second Ave.
Detroit 3, Mich.

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Kansas City, Kans.

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Fond du Lac, Wis.

Casting Specialties Co.
Thiensville, A Wis.

Cerro de Pasco Sales Corp.
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New York 22, N.Y.

Challenge Machinery Co.
First St.
Grand Haven, Mich.

Chandler & Price Co.
6000 Carnegie Ave.
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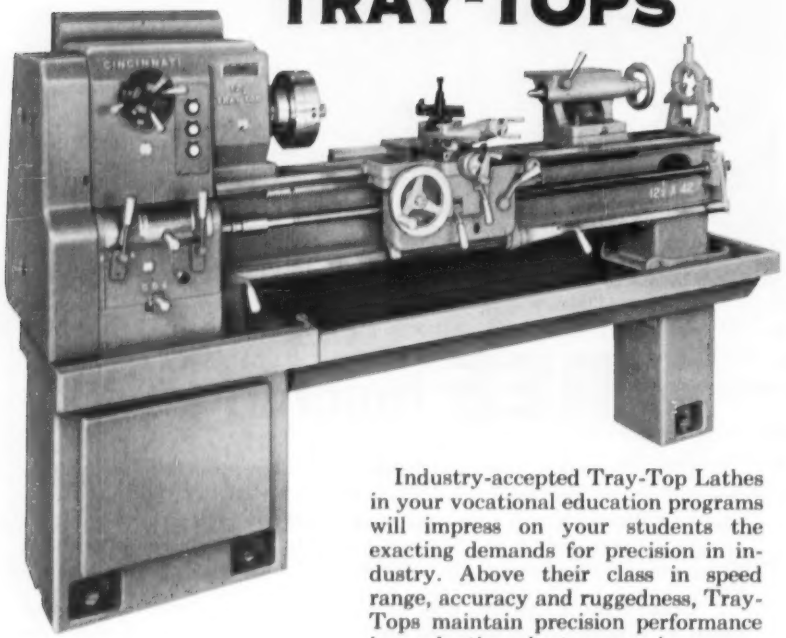

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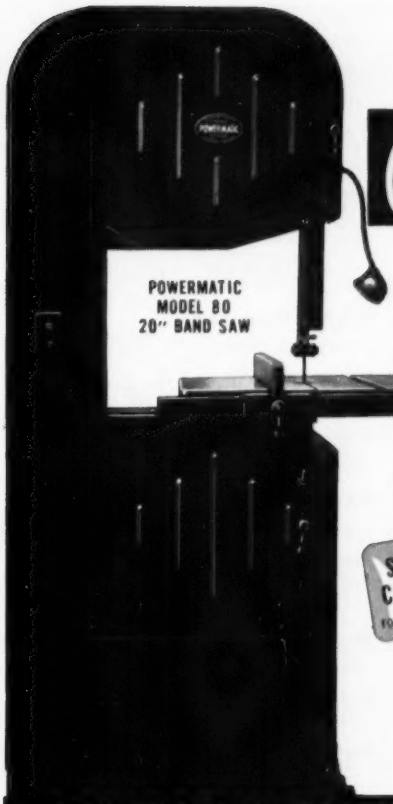

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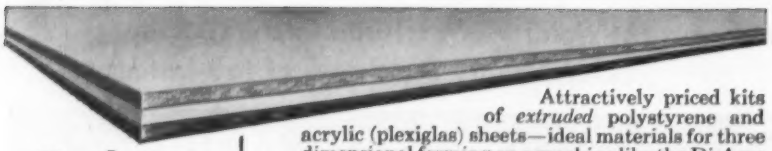

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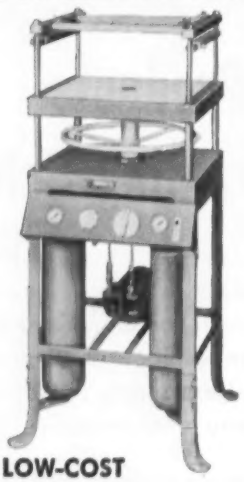

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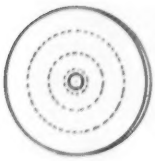

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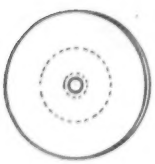

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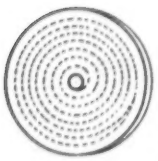

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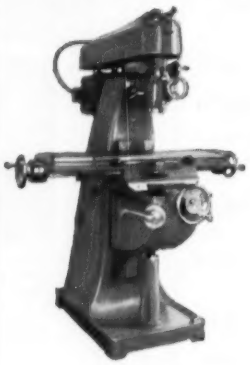

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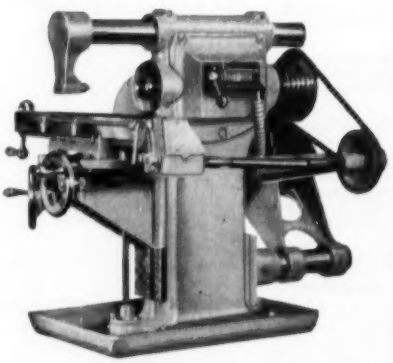

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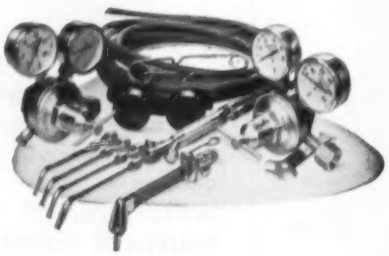

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Marquette makes a welding electrode or gas rod for every welding application. From its famous No. 130 Red Rod for getting deep penetration in dirty, rusty metal to its No. 15 Presto-Arc rod for high speed welding of sheet metal, Marquette offers the best for any shop. This range of rods includes high tensile, hard surfacing, cast iron, special alloys and bronze rods.

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Materials and Supplies Checklist

An easy method to find and account for all the various items used in the school shop is a small pocket-sized notebook in which everything is systematically listed, alphabetized, and location given, according to Calvin T. Stott, Eichelberger Senior-High School, Hanover, Pa. This quick checking device, of course, does not take the place of inventory records, but when various items become low and require reordering a simple red dot will signify that the item has reached the requisition stage. ★

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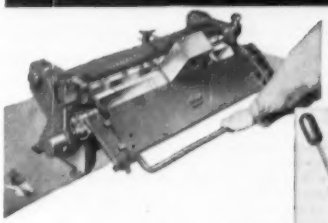

Bench Model BB 2 with all the features of the larger machines; Capacity 24", 16 Gauge

Floor Model, Capacity 3 to 10 feet and up to 12 gauge

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CHICAGO

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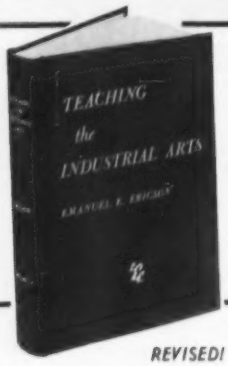

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This revised edition has been rewritten extensively in recognition of changes and developments which have taken place since the original volume was presented. Informative revisions have been made on such important material as methods and procedures in teaching class organization and shop management, safety instruction and accident prevention, testing and recording pupil progress and making courses of study. The first ten chapters deal with the teaching activities of the complete school year, while the remaining chapters deal with many of the added responsibilities of the teacher outside the classroom. Tells how to simplify, improve and really enjoy your work.

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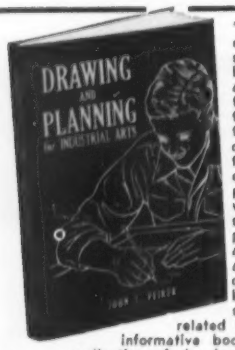

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Automobile Repair Manual. 28th ed. Grey. Chilton. $6.95.

Automobile Trouble Shooter. Rev. ed. Motor Book Dept. $1.20.

Auto Repair Manual. Rev. ed. Motor Book Dept. $5.21.

Automotive Marketing Guide. Ainsworth. Chilton. $25.00.

Automotive Specialists' Service Manual. Grey. Chilton. $2.00.

Diesel Operation and Fault Diagnosis. Fox. Macmillan. $4.50.

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Flat Rate and Service Manual. Grey. Chilton. $15.00.

Flat Rate Manual. Grey. Chilton. $8.00.

High-Speed Combustion Engines. 16th ed. Heldt. Chilton. $12.00.

How to Get Ahead in the Automotive Business. Crouse. McGraw-Hill. $1.00.

Instructor's Manual for Automotive Mechanics. 3rd ed. Crouse. McGraw-Hill.

Tractors & Crawlers. Frazee and Eshelman. American Technical Society. In press.

Workbook for Automotive Chassis. 2nd ed. Crouse. McGraw-Hill. $1.32.

Workbook for Automotive Electricity. 2nd ed. Crouse. McGraw-Hill. $1.40.

Workbook for Automotive Engines. 2nd ed. Crouse. McGraw-Hill. $1.48.

Wreck Estimator. Grey. Chilton. $26.00. (Supplements $23.00 per year.)

Building Trades

Blueprint Reading & Sketching—Carpentry Trades—Residential. McDonnell and the Connecticut Department of Education. Delmar. $2.50.

Blueprint Reading & Sketching—Plumbing Trades—Commercial and Residential. D'Arcangelo and Guest. Delmar. $2.50.

Builders' Hardware Handbook. Brownell. Chilton. $8.00.

Masonry Simplified, Vol. 1. Tools, Materials, Practice. 2nd ed. Dalzell and Townsend. American Technical Society. About $5.40.

Masonry Simplified, Vol. 2. Practical Construction. 2nd ed. Dalzell and Townsend. American Technical Society. About $5.95.

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Silk Screen Printing. Eisenberg and Kafka. McKnight and McKnight. $1.50.

Electricity

Basic Electrical Principles. 2nd ed. Suffern. McGraw-Hill. $4.00.

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Basic Power Electricity. Vol. 1 & 2. Pansini. Rider. In press.

Industrial Electricity. Vol. 1. 3rd ed. Dawes. McGraw-Hill. $5.50.

Practical Electrical Wiring. 5th ed. Richter. McGraw-Hill. $5.25.

Graphic Arts

Graphic Arts Procedures. 2nd ed. Karch. American Technical Society. About $4.95.

Printing: An Introduction to the Graphic Arts. McGraw-Hill. In press.

Student Printing. Clark. Bennett. $3.72 cl. $2.36 pad.

Industrial Arts

Contemporary Industrial Arts Projects. Sekely. McKnight and McKnight. $2.50.

General Shop. 2nd ed. Groneman and Feirer. McGraw-Hill. $3.88.

Teaching the Industrial Arts. Ericson. Bennett. $4.50.

Teaching Multiple Activities in Industrial Education. Silvius and Curry. McKnight and McKnight. $5.00.

Machine Shop

Automation (for the machine trades). Rusinoff. American Technical Society. In press.

Machinery's Handbook. 15th ed. Industrial Press. $9.00.

Machine Shop Training Course. Industrial Press. Two volumes. $9.00.

Machine Tools. Industrial Press. $5.50.

Machinists' Ready Reference. Weingartner. Prakken Publications. $1.50.

Mechanical Drawing and Drafting

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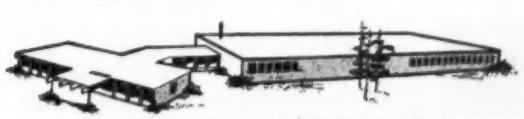

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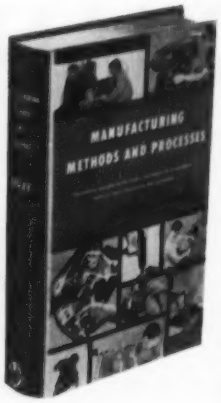

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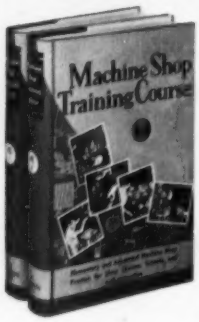

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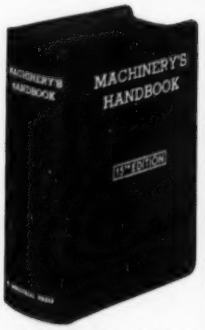

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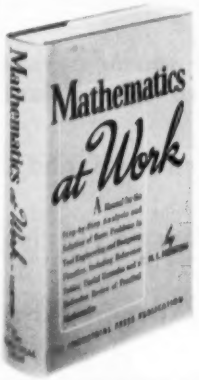

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G. Harold Silvius is professor of industrial education, Wayne State University.

Estell H. Curry is supervisor of industrial arts, Detroit Public Schools.

Practical House Carpentry. Wilson. New York: McGraw-Hill Book Co. 1957. Pp. xii+360. $5.50.

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J. Douglas Wilson was formerly supervisor of vocational curriculums, Los Angeles City Schools.

Radio Receiver Laboratory Manual. Levey. New York: John F. Rider Publisher, Inc., 1956. Pp. 105. $2.00.

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Alex W. Levey is an instructor in the Long Island Agricultural and Technical College.

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Alf Dahl is head of the building trades department in the Trade-Technical Junior College, Los Angeles, California.

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E. Paul DeGarmo is professor of industrial engineering, University of California, Berkeley.

Additional 1955 Television. (Vol. TV-10.) Beitman. Highland Park, Ill.: Supreme Publications, 1955. Pp. 192. $3.00.

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TV Servicing Course. Beitman. (Second Edition.) Highland Park, Ill.: Supreme Publications, 1956. Pp. 192. $3.00.

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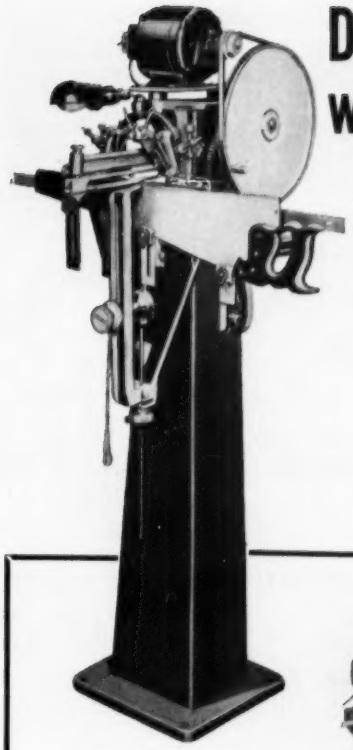

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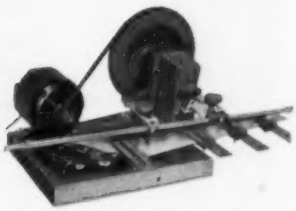

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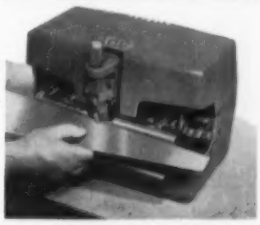

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The Operation of a Local Program of Trade and Industrial Education portrays the general structure of such a program and indicates its functions and personnel. Viewpoints represent a variety of experiences in the different states. Price is 45c and the booklet, published by the U. S. Office of Education, may be ordered from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

Extraclass Activities in Aviation, Photography, and Radio, published by the U.S. Office of Education, explains various club activities which can be planned in these areas. Price is 25c and the pamphlet may be ordered from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

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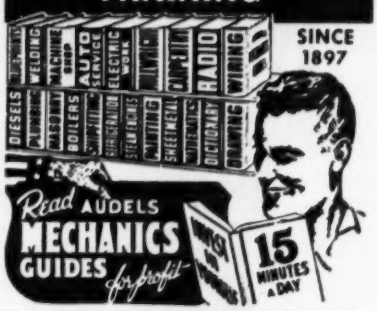

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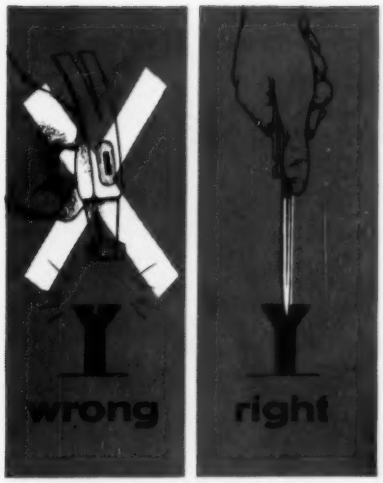

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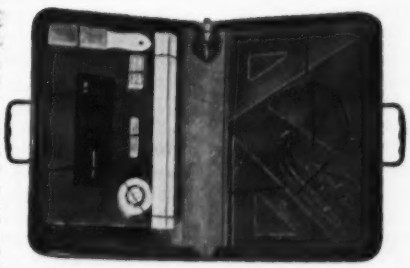

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Automotive

A Car Is Born is the title of an instructional kit issued by the Ford Motor Company and includes a teacher's guide, a color-illustrated student's manual and three filmstrips. Available from Department of Educational Affairs, Ford Motor Company, Dearborn, Mich.

An Introduction to the Automotive Electrical System is an 18-minute, sound, slide film in color containing approximately 80 frames and narrated on two sides of a 16-inch record. It can be purchased or borrowed from Technical Editor, Technical Literature Section, Delco-Remy Division, General Motors Corp., Anderson, Ind.

Facts about Filters is a slide film, dealing in nontechnical language, with the manufacture and use of oil filters in automobiles, trucks, and tractors. Free from PurOlator Products, Inc., Educational Film Division, 970 New Brunswick Ave., Rahway, N. J.

Ignition and Spark Plugs is a 16mm, sound, b and w film which runs 20 minutes. Animated drawings explain the automobile ignition system and component parts. Free-loan basis from Bray Studios, Inc., 729 Seventh Ave., New York 19, N. Y.

The World Makes an Automobile is a wall-chart map showing where the various materials which compose today's car are located in the world. Available from Public Relations Department, Automobile Manufacturers Assn., 320 New Center Bldg., Detroit 2, Mich.

Crafts

Have a Hobby is a 16mm color film which demonstrates how assembling plastic models of everything from early American housewares and antique autos to jet aircraft can be a fascinating hobby. Running time is 13 minutes. Free from Monsanto Chemical Company's Plastics Division, Springfield, Mass.

Leather Carving and Figure Carving is a 16mm sound film available on request from J. C. Larson Co., Inc., 820 S. Tripp Ave., Chicago 24, Ill.

Drafting and Mechanical Drawing

Mechanical Drawing is a series of three film strips on mechanical drawing. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36, N.Y.

Space is a 10-minute, color film which illustrates ways of showing space and distance in drawings. Price is $100 and the film is available from Bailey Films, Inc., 6509 DeLongpre Ave., Hollywood 28, Calif.

Graphic Arts

Films Relating to Printing and Graphic Arts is a listing of films on this subject. Price is 25c and the catalog may be obtained from Michigan Industrial Education Society, Inc., 4029 Allen Ct., Bay City, Mich.

Putting a Job on the Platen Press is a b and w, sound, 16mm film showing procedure for inking, putting in form, preparing simple packing, marking for and inserting guides, adjusting for position and impression. Running time is 11 minutes. Price is $50. Write Bailey Films, Inc., 6509 DeLongpre Ave., Hollywood 28, Calif.

Machine Shop and Metalworking

Decimal equivalents for all fractions wall chart also includes decimal equivalents of all number and letter-size drills; tap sizes and tap drill sizes; pipe thread sizes and tap drill sizes. Free from Dept. SS, The L. S. Starrett Company, Athol, Mass.

Di-Acro Forming Plastic Sheet Materials is a 16mm, color film offered by O'Neil-Irwin Manufacturing Co., 611 8th Ave., Lake City, Minn.

Extending the Range of Modern Surface Grinding is a 16mm, sound, color film explaining the phases of surface-grinder application. DoALL Company, Des Plaines, Ill.

Lathe Parts Wall Chart is an instructional aid offered by Logan Engineering Company, 4901 W. Lawrence Ave., Chicago 30, Ill.

Metal Spinning is covered by four films. Included are: tools and materials; fundamental techniques; the use of chucks in spinning; deep draws and sectional chuck spinning. Each film is one reel, sound, in color or b and w. Almanac Films, Inc., 516 Fifth Ave., New York 36, N. Y.

New Horizons in Aluminum Brazing is a

(Continued on page 106)

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Tools of Abundance is a 28-minute, color, sound, 16mm film dealing with functions of design engineers, process engineers, tool engineers, tool grinders, machine operators. Free loan from the Wesson Company, 1220 Woodward Heights Boulevard, Ferndale 20, (Detroit), Mich.

Radio and Television

The Story of Television is a 16mm, sound, color and b and w film which runs 27 minutes. Early research experiments in the 1920's as well as history-making scenes in the 1940's are included. Actual color shows in the making are presented. Free-loan basis from Institute of Visual Training, 40 E. 49th St., New York 17, N. Y.

Welding

Always on the Job is a 20-minute sound-slide film covering the basic principles of safety in electric arcwelding. Available on a free-loan basis or purchase price is $15. Air Reduction Sales Company, 150 East 42nd St., New York 17, N. Y.

Seven background and how-to-do-it films on oxy-acetylene welding, sound, and color. Priced from $56.25 each. Available from Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

Welding Advances with Aluminum is a color film describing modern developments in inert gas and shielded arc welding of aluminum. Running time is 28 minutes. Available on loan from Association Film Libraries in: Ridgefield, N. J. (Broad at Elm), Chicago (79 E. Adams St.), Dallas (1108 Jackson St.), and San Francisco (351 Turk St.).

Welding and Cutting Equipment wall charts, size 18″ x 23″, includes 4 cross-section drawings of oxy-acetylene torches, 1 cross section regulator chart. Set of 5 is $1. Modern Engineering Co., 3411 Pine Blvd., St. Louis 3, Mo.

Woodworking

A New Approach to Saw Guarding is a 16mm, 15-minute sound film demonstrating the Brett-Guard, a plastic and metal safety guard and guide for power saws. Free. Brett-Guard Company, Glenwood Industries, Inc., Englewood, N.J.

Chisels for Woodworking is a series of nine filmstrips dealing with different types of chisels. B and w 35mm film and a manual of questions is included. Stanley Tools, New Britain, Conn. Price is $5 per set.

Films for the Woodworking Shop explain and demonstrate some of the problems and techniques of shop work. Nine films in the group are priced from $50 each. Young Amer-

ica Films, Inc., 18 E. 41st St., New York 17, N. Y.

How to Use Saws and Tools is a set of 6 wall charts available from Henry Disston Division, H. K. Porter Company, Inc., Philadelphia 35, Penn.

Industrial Arts: Wood Finishing explains and demonstrates the major materials and procedures used in finishing wood and is designed for high-school woodworking shop classes. Price is $62.50; length, 1¼ reels. Young America Films, Inc., 18 E. 41st St., New York City 17, N. Y.

Radio Wave Wood Welding is presented in a 1200-ft. reel, 16mm, color movie. Plastic heat sealing and other methods are discussed. Free loan from Woodwelder Manufacturing Plant No. 2, 355 N. Newport Blvd., Newport Beach, Calif.

Use of the DeWalt Power Saw is a 16mm, 25-minute, sound film which explains woodworking procedures. Free on request from DeWalt, Inc., 710 Fountain Ave., Lancaster, Penn.

Vise Maintenance Chart is a chart giving steps to aid students in maintenance. Available from Columbian Vise and Manufacturing Co., 9021 Bessemer Ave., Cleveland 4, Ohio.

Wood Sample Set contains approximately 48 pieces, ¼" x 2¼" x 5¾", of wood, all different species. Price per set $4.50. Frank Paxton Lumber Co., 6311 St. John Ave., Kansas City 23, Mo.

Miscellaneous

Aluminum on the March is a 16mm sound and color film with a showing time of 28 minutes which depicts the manufacture and industrial utilization of aluminum. Free-loan basis from Association Films in Ridgefield, N. J. (Broad and Elm), LaGrange, Ill. (561 Hillgrove Ave.), San Francisco, Calif. (799 Stevenson St.), and Dallas, Tex. (1108 Jackson St.).

An Introduction to the Heat Engine is a b and w, 20-minute film explaining how engines provide power for moving, building, manufacturing. Loan from Shell Oil Co., 50 W. 50th St., N. Y. 20, N. Y.

Bright Steel is a 16mm, sound, color film describing the production of tinplate and its use in food canning, bottle capping, and other industries. Free loan basis from Modern Talking Picture Service, Inc., 3 E. 5th St., New York 22, N. Y.

Design illustrates how design is used in creating a work of art. In color, running time 10 minutes, the price is $100. Available from Bailey Films, Inc., 6509 DeLongpre Ave., Hollywood 28, Calif.

Fifty-seven films on nearly every subject are listed in General Motors' new motion picture film catalog. Free-loan basis, all with sound, some color, the film listings may be obtained from General Motors Corp., Educational Services, General Motors Building, Detroit 2, Mich.

How Basic Tools Created Civilization is an 8-color chart, 33" x 46", suitable for mounting. Cost is 50c and the chart is available from the DoALL Company, Educational Material Division, 254 North Laurel Ave., Des Plaines, Ill.

Industrial-Arts Training Folder is a 29-page file of illustrated data sheets on the use of redwood in the shop. Included are photographs, drawings, and technical tables. Free from California Redwood Assn., 576 Sacramento St., San Francisco, Calif.

(*Continued on page* 108)

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Industrial Education in Your Future is a 21-minute, sound, color film which shows how high-school students' interest in industrial vocations may be directed toward a college career in industrial education. Free from Division of Industrial Education, Stout State College, Menomonie, Wis.

Local 100 has a running time of 32 minutes and relates the beginning of the organization of a trade union; collective bargaining and how it was carried on to obtain a contract providing job security. Price is $145 and the film is available from Text-Film Department, McGraw-Hill Book Company, 330 W. 42nd St., New York 36, N. Y.

Plastic Wall Tile Selfinstallation is a 20-minute, color film showing steps to take in remodeling a bathroom or kitchen with Matico Plastic Wall Tile. Request from Mastic Tile Corp. of America, Box 986, Newburgh, N. Y.

Play It Safe is a sound, color film which teaches bicycle safety to youngsters. Available from Bicycle Safety Program, Johnson & Johnson, New Brunswick, N. J.

The Story Behind a Bottle is a 16 or 35mm film in Eastman color. Running time is 24 minutes and the film tells the story of glass containers, from their origin to present-day glass makers. Available from Glass Container Manufacturers Institute, 99 Park Ave., New York 16, N. Y.

The Structure of Unions is an 11-minute b and w or color cartoon film which examines the organization of labor unions today. Price for b and w is $50, color, $110. Available from McGraw-Hill Text-Film Department, 330 W. 42nd St., New York 36, N. Y.

Tools Make America Great is a 15½" x 22½" color wall chart showing the relationship of tool development to the American way of life. Cost is 50c and the chart is available from DoALL Company, Educational Material Division, 254 Laurel Ave., Des Plaines, Ill.

Why Study Industrial Arts is a guidance film designed to help students determine whether they want to enter industrial-arts courses in high school and college. Young America Films, Inc., 18 East 41st St., New York 17, N. Y.

Drafting . . . . . *from page 28*

A tool panel that can be closed and locked, similar to tool panels used in other industrial-arts laboratories, can be devised to make available to students tools and instruments that are not used daily (such as trammels, for instance).

Drawing boards may be left at the bench, stacked, or placed in a holder similar to the type used for dining-table leaves. T-squares may be hung by the head in a slotted board with the edge of the blade turned out, so an accurate check can be made at a glance. They may also be suspended by the head between two horizontal hangers or hung by the blade on a dowel rod.

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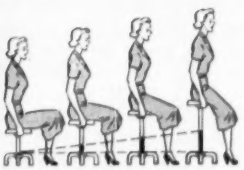

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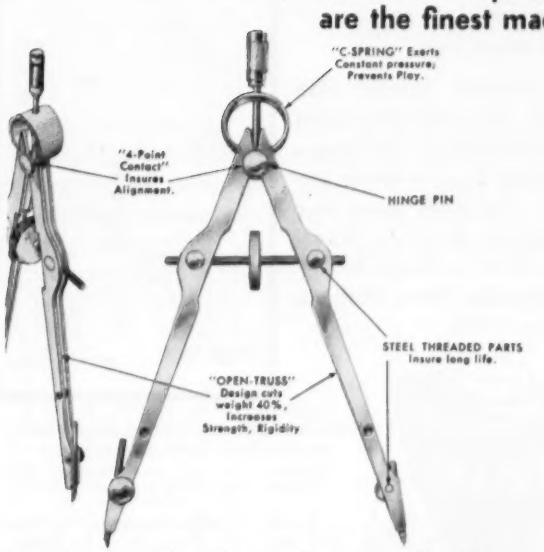
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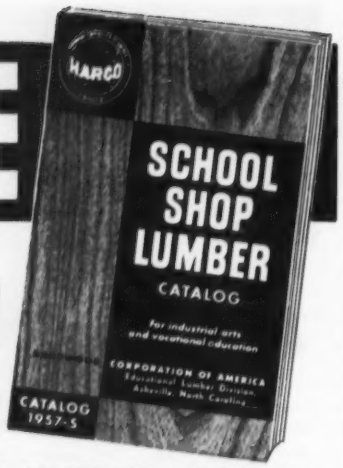

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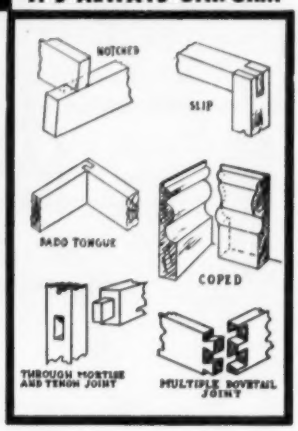

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Directory of Federal and State Officials

This up-to-date list of federal and state officials in vocational and industrial-arts education has been carefully compiled from authoritative sources. Thanks are due all the state directors of vocational education and the U. S. Office of Education for their help in preparing this directory. Keep this directory for ready reference during the year.

U. S. Office of Education Vocational Education Division Washington 25, D. C.

James H. Pearson, assistant commissioner and director for vocational education.

Ward P. Beard, assistant director.

Lane C. Ash, assistant director.

Trade and Industrial Education Branch

John P. Walsh, director.

Earl M. Bowler, assistant director.

Walter H. Cooper, program specialist, Central region.

Richard S. Nelson, program specialist, Pacific region.

William P. Loomis, program specialist, North Atlantic region.

Edward G. Ludtke, program specialist, Southern region.

Allen T. Hamilton, research specialist.

Mary S. Resh, specialist, training for girls and women.

Howard K. Hogan, consultant, employer-employe relations.

Secondary Education

Marshall Schmitt, industrial-arts specialist.

Alabama

R. E. Cammack, director, vocational education, Montgomery 4.

J. C. Cannon, supervisor, agricultural education, Montgomery 4.

J. F. Ingram, supervisor, trade and industrial education, Montgomery 4.

Alaska

Howard M. Matthews, director, vocational education, department of education, Juneau.

Arizona

J. R. Cullison, director, vocational education, Phoenix.

William R. Woodfin, supervisor, trade and industrial education, Phoenix.

Bob E. Taylor, supervisor, agricultural education, Phoenix.

Arkansas

J. Marion Adams, assistant commissioner for vocational education, Little Rock.

J. C. Ruppert, supervisor, trade and industrial education, Little Rock.

George F. Sullards, supervisor, agricultural education, Little Rock.

California

Wesley P. Smith, director, vocational education, Sacramento 14.

B. J. McMahon, chief, bureau of agricultural education, Sacramento 14.

Samuel L. Fick, chief, bureau of industrial education, Sacramento 14.

Ernest G. Kramer, assistant supervisor, bureau of industrial education, Sacramento 14.

Van B. Lawrence, regional supervisor, bureau of trade and industrial education, Sacramento 14.

G. L. Rosecrans, supervisor in charge of apprentice training, 2082 Center St., Berkeley.

Mack Stoker, regional supervisor, bureau of trade and industrial education, Room 809-J, California State Bldg., Los Angeles.

Sidney E. McGaw, regional supervisor, bureau of trade and industrial education, 2082 Center St., Berkeley.

David Allen, special supervisor, bureau of trade and industrial education, Room 809-J, California State Bldg., Los Angeles.

Wallace Theilmann, supervisor, instructional materials program, Sacramento 14.

Robert L. Woodward, consultant in industrial-arts education, Sacramento 14.

Colorado

A. R. Bunger, director, vocational education, Denver.

W. G. Flannery, supervisor, trade and industrial education, Denver.

M. G. Linson, supervisor, agricultural education, Denver.

Connecticut

Emmett O'Brien, director, division of vocational services, Hartford 15.

G. Wesley Ketcham, consultant, industrial arts, Hartford 15.

Walter Jacoby, consultant, agricultural education, Hartford 15.

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Anna C. Moore, consultant, vocational school general education and libraries, Hartford 15.

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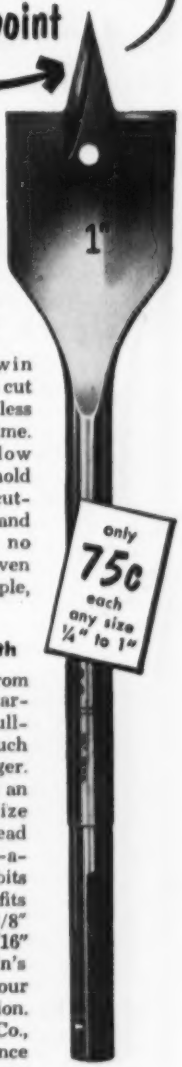

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Joseph Murphy, consultant, audio-visual education, Hartford 15.

Gordon Harrington, consultant, research in vocational education, Hartford 15.

Ralph Kiersted, consultant, vocational school mathematics and science, Hartford 15.

Delaware

R. W. Heim, assistant superintendent for vocational education, 313 S. State St., Dover.

A. B. Anderson, director, trade and industrial education, 511 W. Eighth St., Wilmington 43.

Frank M. Forstburg, supervisor, trades and industries in charge of foreman training, 511 W. Eighth St., Wilmington 43.

W. Lyle Mowlds, director, agricultural education, 313 S. State St., Dover.

Irvan V. P. Chelly, supervisor, trade and industrial education in charge of apprentice training, 313 S. State St., Dover.

District of Columbia

F. A. Gregory, assistant superintendent, industrial education, Franklin Administration Bldg., Washington 5.

Harold A. Clark, director, industrial education, Wormley School, 3331 Prospect Ave., N.W., Washington 7.

E. P. Westmoreland, supervising director, trade and industrial education, Wormley School, 3331 Prospect Ave., N.W., Washington 7.

W. H. Payne, supervising director, industrial arts, Wormley School, 3331 Prospect Ave., N.W., Washington 7.

P. J. Rayford, supervising director, agricultural education, Woodrow Wilson High School, Nebraska Ave. & Chesapeake St., N.W., Washington 16.

Florida

Walter R. Williams, Jr., director, vocational and adult education, Tallahassee.

Harry E. Wood, supervisor, agricultural education, Tallahassee.

Thurman Bailey, supervisor, trade and industrial education, Tallahassee.

E. A. Emmelhainz, area supervisor, trade and industrial education, Tallahassee.

E. B. Heiny, area supervisor, trade and industrial education, Tampa.

Fred Thornton, area supervisor, trade and industrial education, Jacksonville.

Edwin L. Kurth, consultant, industrial arts, Tallahassee.

B. J. Nelms, educational materials specialist, Tallahassee.

W. L. Lightsey, coordinator, labor-management conference training, Lutz.

Georgia

George I. Martin, director, vocational education, Atlanta 3.

T. G. Walters, supervisor, agricultural education, Atlanta 3.

W. M. Hicks, supervisor, trade and industrial education, Atlanta 3.

G. F. Mulling, assistant supervisor, trade and industrial education, Atlanta 3.

Hawaii

W. H. Coulter, deputy superintendent, division of vocational education, Box 2360, Honolulu 4.

C. R. Ferdun, director, agricultural education, Box 2360, Honolulu 4.

Albert J. Feirer, director, trade and industrial education, Box 2360, Honolulu 4.

Lucian J. Paulus, assistant director, trade and industrial education, Box 2360, Honolulu 4.

Idaho

George E. Denman, director, vocational education, Boise.

S. R. Glenn, supervisor, trade and industrial education, Boise.

J. E. Marmon, assistant supervisor, trade and industrial education, Boise.

Emory M. Howard, supervisor, agricultural education, Boise.

Illinois

J. E. Hill, director, vocational education and chief, agricultural education, Springfield.

Edward M. Claude, chief, trade and industrial education, Springfield.

S. James Senes, supervisor, trade and industrial education, Chicago.

Walter J. Bartz, supervisor, trade and industrial education, Springfield.

H. A. Meinert, supervisor, trade and industrial education, Springfield.

Fred W. Swan, supervisor, trade and industrial education, Springfield.

Robert B. Newell, supervisor, trade and industrial education, Springfield.

James F. Meyerhofer, supervisor, trade and industrial education, Springfield.

Amos D. Coleman, supervisor, industrial arts, Springfield.

John W. Walgren, supervisor, industrial arts, Springfield.

Eurus Stoltz, supervisor, trade and industrial education, Springfield.

Indiana

Wilbur Young, superintendent of public instruction and director, vocational education, Indianapolis 4.

W. A. Williams, administrative assistant and acting director, vocational education, Indianapolis 4.

Harold Taylor, supervisor, agricultural education, Indianapolis 4.

———, supervisor, trade and industrial education and distributive education, Indianapolis 4.

John Conaway, supervisor, industrial-arts education, Indianapolis 4.

Iowa

Wayne L. Pratt, director, vocational education, 542 State Office Building, Des Moines 19.

Hampton T. Hall, supervisor, agricultural education, 542 State Office Building, Des Moines 19.

O. H. Beaty, supervisor, trade and industrial education, 542 State Office Building, Des Moines 19.

Kansas

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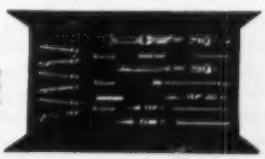

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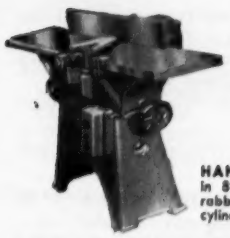

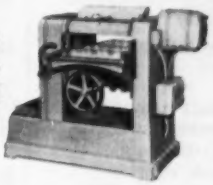

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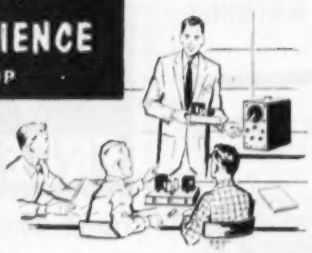

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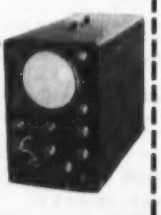

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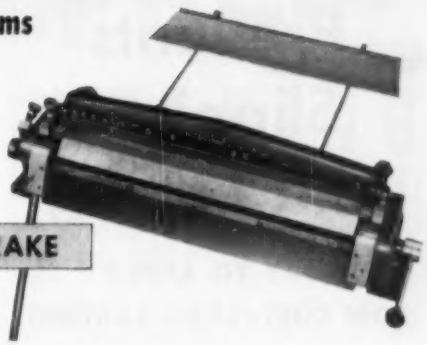

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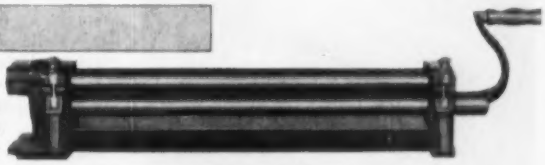

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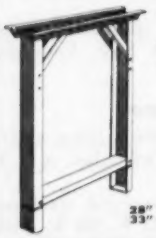

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KINKS

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Retrieve Dropped Solder

Bits and pieces of dropped solder can easily be salvaged by placing them in a tin can fitted with a stiff wire handle and bending the top of the can to form a spout. Then clamp an 18"-long piece of ¾" or 1" angle iron in a vise so the opening faces upward; heat the can till the solder melts, then pour the melted solder into the "V" of the angle iron. When cool, turn the angle iron over, give it a slight tap and out will fall a serviceable stick of solder.—*Harvey Muller, Box 6, Danboro, Penn.*

Efficient Handle

Anybody who uses a yardstick for blackboard work will find this measuring device much easier to handle if a simple grip is attached. Use a window-screen handle and screw it to the center of the yardstick.—*Roger M. Woodbury, Wellesley Junior High School, Wellesley, Mass.*

Start on a Lid

The small cans used as containers for frozen juices are convenient holders for glues and finishes, especially when they have fitted wooden lids. Two different kinds of lids are kept on hand in my shop, along with a supply of the cans.

Lids are turned from ½" stock on the lathe with a screw center. Some are drilled with a 5/16" hole to fit tightly over the handle of an acid brush (acid brushes come in different sizes). This combination makes a disposable glue pot. Other lids can be fitted with a nail or wood screw for a handle which makes a general-purpose container.

Such lids can be turned out by the instructor like hotcakes, but I find they make a good starter project for students on the wood lathe.—*Frank Duveneck, Los Altos, Calif.*

Short-Stock Supply

The secret in using up short stock is to have it readily available. We constructed a simple, rugged box, about 10" deep, 3½' across and 4½' long, and mounted it on rubber casters. Expense and storage difficulties are removed with this reservoir since longer materials are not whittled down so fast.—*Arthur R. Herbert, Paxton Community Unit Schools No. 2, Paxton, Ill.*

For Easier Adjustment

Depth adjustment collars can be improved when you remove them entirely and replace them with a small collar and a thumb-type set screw. This is quick and accurate and saves nerves.—*Don Kinnaman, Glendale, Ariz., High School.*

Drop the Oil

Tiny oil holes that would be flooded by the use of a large oil can still may be properly oiled by using an eyedropper. Be careful not to draw oil clear up into the rubber bulb, as the oil will cause it to deteriorate.—*Hugh Lineback, Oklahoma A & M College, Stillwater.*

Pictures Help Memories

On several pieces of paper, I have cut out and mounted pictures of major tools we have in our tool crib. Under each tool, the name is printed. A boy needing a specific tool and not knowing what it is has only to look for the name on the sheet and see what the tool looks like. When he does his own looking and identifying in this manner, I believe he

TEACH METAL WORKING EASILY AND INEXPENSIVELY WITH THE

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START YOUR WROUGHT-METAL PROGRAM

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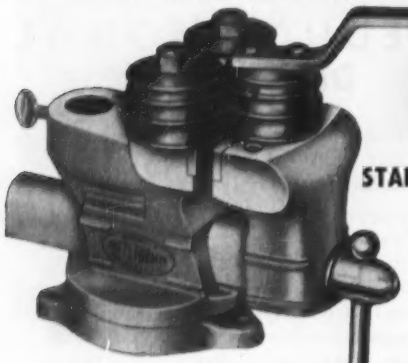
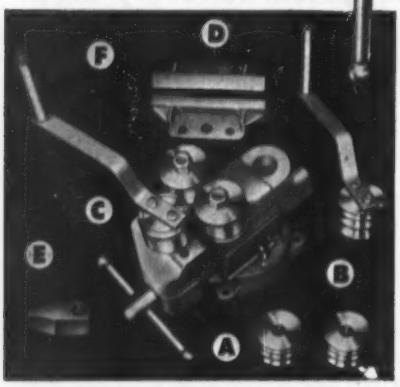


The Metl-Former, a new light-metal combination tool, opens a new educational phase of school shop activity—*easy, inexpensive metal working!* The versatile Metl-Former forms, rolls, and bends light metals with fingertip tension—changes raw materials into useful and instructive wrought-metal tables, planters, and lamps. It illustrates important metal-working principles and applications, simply and easily. No additional strength is required to operate the Metl-Former and changes from one operation to another are quickly made. Mistakes in metal shaping are quickly erased by reversing the operation, cutting *costly* scrap to a minimum. Instructive values of the Metl-Former are unlimited. There's *double value*, as the Metl-Former also serves as an *extra* shop vise.

THE METL-FORMER KIT



KIT CONTENTS

A. Basic Metal-Forming Tool
B. 3 Tubing and Rod Rollers
C. 3 Flat Metal Rollers
D. 1 Sheet Metal Bender
E. 1 Flat Metal Bending Wedge
F. 2 Roller Handles

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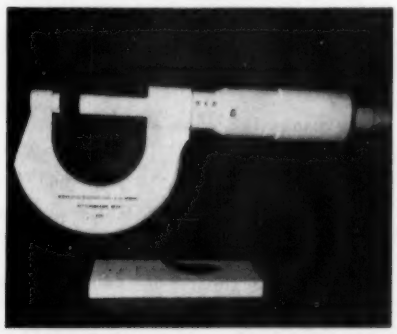
Write for full information, today, about the new, instructive, metal-shaping tool, the Metl-Former, plus the handy group of optional accessories.

remembers better.—*Wesley L. Adams, Laconia, N.H., High School.*

Blast It with Rays

To get a sharp casting, it is necessary to drive out excess moisture from the sand mold. This can be done easily by mounting two infra-red heat lamps in the bottoms of two 5-gallon cans or large buckets and inverting them over each half of the open mold. The penetrating infra-red rays will dry the sand in a few minutes.—*Louis J. Enos, Lincoln Junior High School, Sacramento, Calif.*

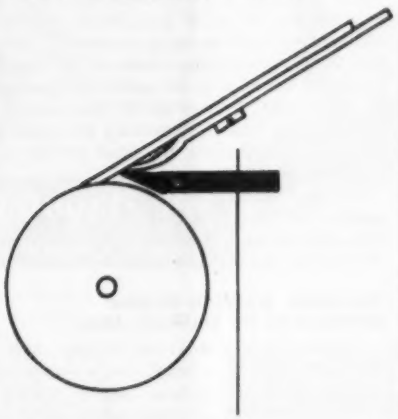
Giant Instructional Aid



Our patternmaking classes built a micrometer model which has proved a valuable instructional aid. The working model, made largely of wood, is 44" long and 23" high. The only metal parts are the screw and nut which provide the longitudinal travel to the spindle and which were made in the machine shop. The micrometer is so constructed that one revolution of the thimble will move the spindle ¼". This exaggerated movement corresponds with the graduations on sleeve and thimble. Blank numerals and markings on a white enamel finish make it easy for an entire class to observe a demonstration or lesson on the use of a micrometer.

Any teacher interested in building a similar model may write me for free drawings and instructions.—*Robert E. Larson, Minneapolis Vocational High School and Technical Institute, 1101 Third Ave., South, Minneapolis, Minn.*

Novel Grinding Guide



We observed a carpenter using this kink a number of years ago. To sharpen a plane bit on a grinding wheel, remove the blade assembly from the plane bed and separate the bit and cap iron by removing the cap iron screw. The cap iron is then reassembled on the underside of the plane bit and fastened firmly in place with the cap iron screw. As shown in the drawing, the cap iron serves as a guide for keeping the blade square with the surface of the grinding wheel.—*Charles M. Rice, Western Washington College of Education, Bellingham.*

Sandpaper Ownership

To keep the consumption of sandpaper down to what we consider average, we use this method: Issue sheets of sandpaper to each student in the common grits used for the particular shop course taught. Fold in quarters and have the student write his name on each quarter. Sandpaper misplaced, misused or wasted can be easily traced to the individual responsible.—*Stanley Schneck, Southern Lehigh High School, Coopersburg, Pa.*

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For student training, Paasche Airbrush Company provides a complete line of airpainting equipment . . . the same type students will use later in commercial work.

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Paasche offers a full line of fine arts airbrushes and accessory equipment for beginning, intermediate and advanced art students. Paasche Airbrushes, simple enough for the beginner, are also tools of the skilled craftsman.

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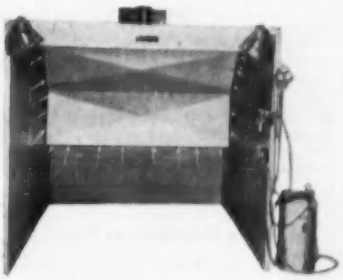

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To find the names and addresses of suppliers of shop tools, materials, and equipment, use the Suppliers Directory on pages 78-92 of this issue. Keep for future reference.

Leathercraft, Copper Enameling, Mosaic Tile, Shellcraft, Metal Tooling, Beadcraft, Many More Crafts.

Free Big Catalog

KIT KRAFT

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news from Industry

(Circle the numbers on the card in this issue to secure the items listed.)

New Marker-Adder Introduced for TV and FM Alignment

Precision's new Model 220 Marker-Adder is an accessory instrument designed for improving the accuracy and versatility of the conventional sweep generator, signal-marker generator, and oscilloscope.

The manufacturer points out that the Model 220 makes for faster and more accurate RF and IF alignment in TV receivers and FM sets by permitting the use of large-size, highly visible markers, by eliminating the need to connect the marker-signal generator to the tuned circuits of the receiver, by making the marker pip fully visible in traps and at other zero response points, and by preventing the marker signal from overloading the tuner circuits of the receiver.

For more information, write Precision Apparatus Co., Inc., 70-31 84th St., Glendale 27, N.Y., mentioning SCHOOL SHOP; or *circle no. A-1 on the business-reply card.*

Versatile Holding-Device Introduced by DeWalt, Inc.

"Giant Grip," a multi-use holding device that can be used as a bench vise, a drill-press or band-saw fixture, a large capacity wrench, a work clamp, and for other similar applications is now available.

According to the company the new holding tool is designed to eliminate the need for many single-purpose gripping devices now available, *e.g.*, releasing the pressure of a single lock and removing functional portions of the tool from the bench clamp removes the device from one position or spot and makes it available for use elsewhere.

The specification sheet states the device is made of steel and its capacity as a vise or fixture ranges from 0" to 7". By removing the base plate, its capacity can be run up to 9".

For additional information write to DeWalt, Inc., Lancaster, Pa., mentioning SCHOOL SHOP; or *circle no. A-2 on the business-reply card.*

Pencil Company Changes Name

The American Lead Pencil Co., has changed its name to Venus Pen and Pencil Corp.

The new name is based on the picture of Venus de Milo which has graced the firm's packages and products for the past 51 years, or since the time Louis Reckford first encountered a statue of her in the Louvre, shortly after the turn of the century.

The current president of the company, Richard Lewisohn, Jr., made the announcement.

Stanley Tools Adds Two Sanders

Orbital and belt sanders featuring maximum operating efficiency have been added to the Stanley Electric Tools line.

The manufacturer attributes the improvement to their air-cooled motors, ball-bearing construction, vertically positioned "out-of-the way" cords, and balance.

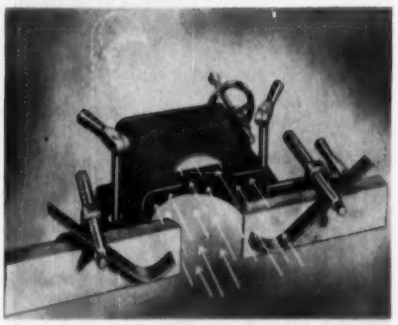
The Stanley H36 orbital sander is a heavy duty tool weighing 6½ pounds and is 11⅜" long, 3¾" wide and 6⅜" high. The pad size is 7 1/16" by 3⅝", and the sander makes 4500 orbits per minute. The orbit size is 3/16".

The firm says the orbital sander is also designed for flush sanding and work in restricted areas. It has two handles, a knob-type in front and a tapered lever-type handle with a slide switch for finger-tip control of sanding action. The knob-type handle can be removed when sanding close to perpendiculars.

The H31 belt sander has power and ventilating systems designed for maximum sanding power with continuously cool operation.

For additional information write to Stanley Electric Tools, The Stanley Works, 111 Elm St., New Britain, Conn., mentioning SCHOOL SHOP; or *circle no. A-3 on the business-reply card.*

Boice-Crane Announces Its Shaving Shute



Boice-Crane's Shaving Shute, a novel fence design for woodworking machines, leaves no place for shavings to go but up, the firm states.

The main body of the fence is rigid, a massive steel box weldment assembly that channels shavings back and out. The maker claims this device will ease the operator's vision.

The manufacturer also claims that an easy inexpensive connection can be made to a unit-type or shop-wide shavings and dust collector.

According to the specifications, the entire 27" fence as a unit and each face independently can be adjusted back and forth. Hard-

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PAT. PEND.
"500"
SERIES

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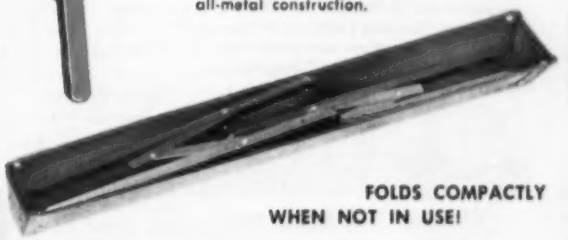

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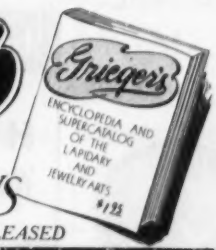

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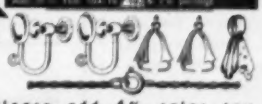

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MAIL ADDRESS: P. O. Box 4185, CATALINA STATION, PASADENA, CALIF.

WHY DO Foredom Flexible Shaft MACHINES
PAY FOR THEMSELVES
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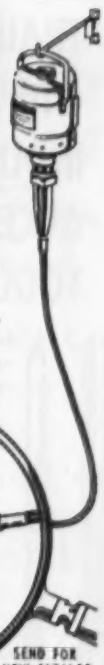

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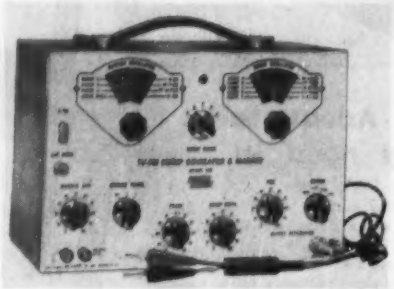
wood faces are 2½" high, each adjustable laterally to suit the cutter diameter.

For further information write to Boice-Crane Company, 938 W. Central Ave., Toledo, Ohio, mentioning SCHOOL SHOP; or *circle no. A-4 on the business-reply card.*

Eico Announces New TV-FM Sweep Generator



The new sweep generator recently introduced by EICO, facilitates alignment of FM, TV monochrome, and color, the manufacturer says.

The new Model 368 is 3-216 mc in five overlapping fundamental bands. The sweep width is continuously variable from 0-3 mc lowest maximum deviation to 0-30 mc highest maximum deviation, the specifications state.

Other highlights listed by the firm are: provision for an external marker; edge-lit hairlines eliminate parallax; a double pi line filter; an output impedance of 50 ohms; narrow range phasing control for accurate alignment; and the elimination of return trace by two-way blanking.

For more information write to EICO, 84 Withers Street, Brooklyn 11, N.Y., mentioning SCHOOL SHOP; or *circle no. A-5 on the business-reply card.*

Drum Sander Now Available

A small diameter Cone-Loc Drum Sander has been added to the American Diamond Saw Sales line.

Four inches in diameter, the sander is a split drum and comes in only a 1½" width, the manufacturer states. It is available, however, with arbor-hole diameters of ½", ⅝" or ¾". The rubber cushion, according to the firm's specifications, is 50 durometer neoprene rubber which will run oil, grease, or other petroleum products.

The company claims that abrasive strips when used on the Cone-Loc Drum Sander, will perform the same work as endless-belt type grinders at a savings of approximately 75 percent in abrasive costs.

For additional information write to the American Diamond Saw Sales, 120 N.W. Ninth Ave., Portland 9, Ore., mentioning SCHOOL SHOP; or *circle no. A-6 on the business-reply card.*

Plomb Tool Becomes Pendleton Tool Industries

Plomb Tool Company announces that its name has been changed to Pendleton Tool Industries, Inc., following a special stockholders' meeting in Los Angeles.

The parent company located in Los Angeles and a division in Jamestown, N.Y., will operate under the name of Proto Tool Company,

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The "Wipe-on" Finish that
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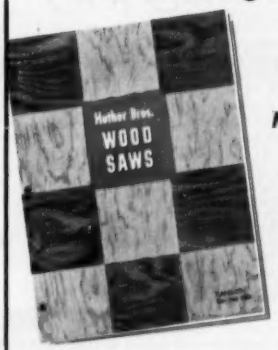

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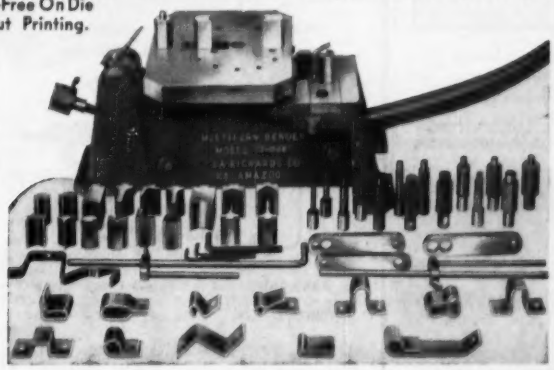

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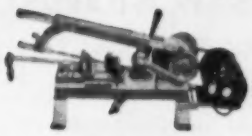

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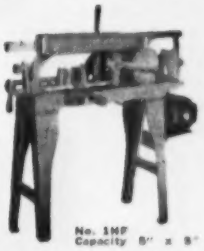

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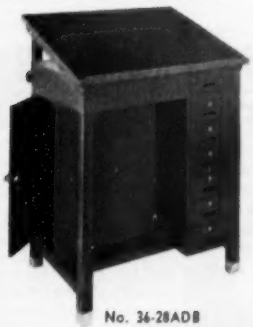

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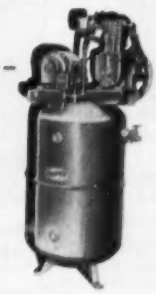

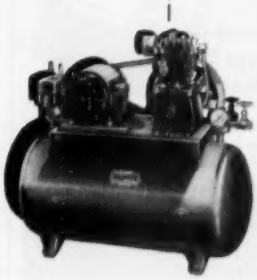

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Please send "FACTS" booklet and Air Compressor data.

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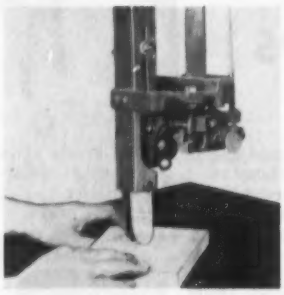

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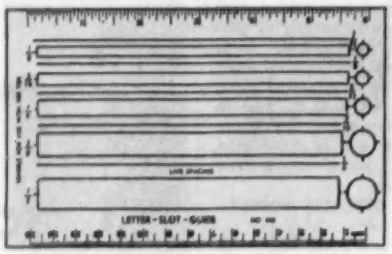
as divisions of Pendleton Tool Industries, Inc.

Following the stockholders' meeting the board of directors stated that the present management will continue its past policies.

Lettering-Slot-Guide Template Announced by Alvin & Co.



A new convenient Lettering-Slot-Guide template, made of .060 thick acrylic material, has been announced by Alvin & Company.

Durable, shatter-proof, and transparent, the new template is cut in five guide slots in the popularly-needed sizes of 1/8", 3/16", 1/4", 3/8", and 1/2". Five circles in these same sizes also have been incorporated in the guide, as well as a 6" ruler in 16ths, and a 6" ruler in millimeters.

For more information and a copy of Alvin's new fully illustrated template catalog, write Alvin & Company, Windsor, Conn., mentioning SCHOOL SHOP; or *circle no. A-7 on the business-reply card.*

Starrett's Vernier Caliper Termed "The Ultimate"

The L. S. Starrett Company in introducing its new Vernier caliper termed it "the ultimate in Vernier gage design."

The tool, the Starrett No. 123 Satin Chrome Master-Vernier Caliper, is designed with both Vernier plates fitting flush with the main scale. This new open-face design, the manufacturer claims, also permits placing both the inside and outside Vernier scales on the same side of the tool.

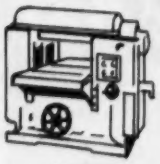
All reading surfaces of the gage are finished in Starrett Satin Chrome, which the firm says, is a long-wearing multi-plate finish that eliminates glare and makes reading the scale easier under even difficult lighting conditions.

For additional information write to L. S. Starrett Company, Athol, Mass., mentioning SCHOOL SHOP; or *circle no. A-8 on the business-reply card.*

Benke Named General Manager of Paasche Airbrush Co.

The appointment of Paul A. Benke as vice-president and general manager of Paasche Airbrush Company was announced in November by Warren P. Scott, president of Cline Elec-

"CRESCENT" Wood-Working Machinery by Enterprise



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Model	Interior Size	Watts	Price
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ELECTRIC PLASTIHEETER

Designed for Use in Plastics Courses in the School For Shaping to the form desired. It is essentially used for straight line bends or folds and is capable of heating sheet material up to ½" in thickness in from 30 seconds to 4 minutes.

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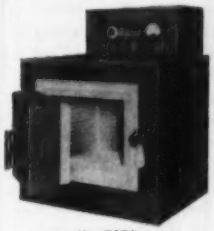
7021	10"x9½"x9"	2.8KW 230 volts	$225



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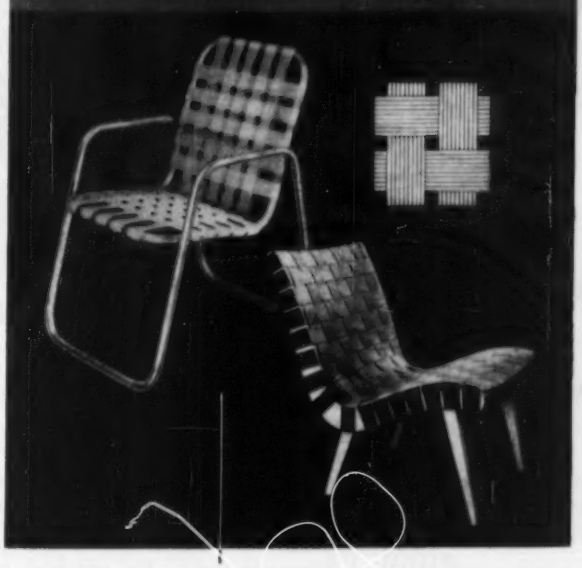

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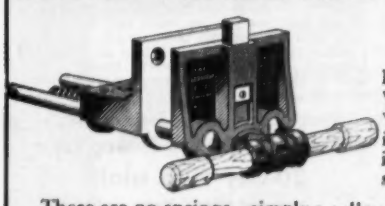

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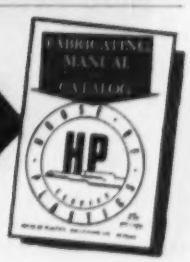

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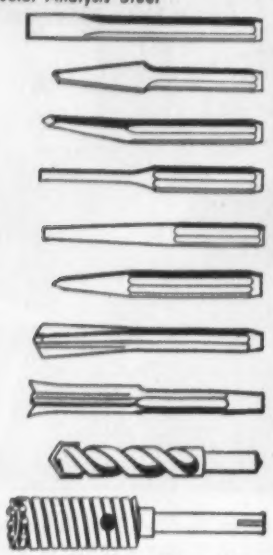

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tric Manufacturing Company of which Paasche Airbrush Company is a division. Paasche Airbrush Company, Chicago, Ill., is a manufacturer of spray painting equipment, automatic finishing units, and artists' airbrushes.

Cabinets Ease Shop Storing Problem

The Herman Nelson School Storage Cabinets have found a new use in school shops, the manufacturer has announced.

The units may be installed singly or nested together and are available in 24", 36", and 48" lengths. Originally designed as matching equipment for Amervent and Hernel-Cool heating, ventilating and cooling units, the firm says the new cabinets can also be used in school shops and classrooms.

For additional information write to the Herman Nelson Unit Ventilator Products, American Air Filter Co., Inc., 215 Central Ave., Louisville, Ky., mentioning SCHOOL SHOP; or *circle no. A-9 on the business-reply card.*

Angle Adapter Makes Vise More Flexible

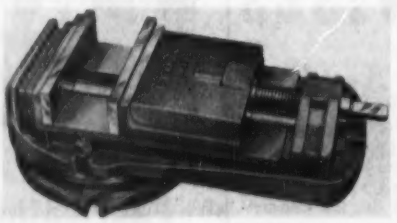
Columbia Vise has recently introduced an angle adapter that makes it possible for a Gyro-Vise to be placed in any position desired.

The adapter is also said to greatly increase the versatility of the vise which normally operates from and rotates around a standard base.

The company says the angle adapter is one of several new features of the No. 73½ Gyro-Vise. Other features include removable and replaceable pipe jaws, 7⅞ square inches of jaw gripping area, 3½" jaw width and 1¾" square polished anvil surface. The adapter weighs 2¼ pounds.

For additional information write The Columbian Vise and Mfg. Co., 9038 Bessemer Ave., Cleveland 4, Ohio, mentioning SCHOOL SHOP; or *circle no. A-10 on the business-reply card.*

L-W Chuck Introduces Three New Vises



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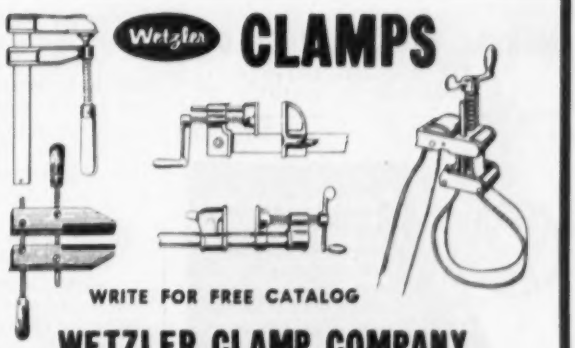

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holding surfaces are at true right angles or parallel to the table, the firm continues.

The three new vises are named the Mogul, Master, and Junior.

For additional information write to the L-W Chuck Co. at 69 S. St. Clair Street, Toledo 4, Ohio, mentioning SCHOOL SHOP; or *circle no. A-11 on the business-reply card.*

New Literature:

Questions and Answers about the Davidson Dual-Lith is a 24-page brochure on the Davidson line of offset equipment, its applications and operations. Photographs and diagrams accompany the questions and answers. For a free copy write the Davidson Corporation, 29 Ryerson St., Brooklyn 5, N.Y., mentioning SCHOOL SHOP; or *circle no. A-12 on the business-reply card.*

Gleason's new Caster Catalog No. 412-A lists more than 40 new models and contains practical applications suggestions. It also includes caster selection data for various operational variables such as load requirements and floor conditions. For a copy write Gleason Corporation, Dept. 412, 250 N. 12th St., Milwaukee, Wis., mentioning SCHOOL SHOP; or *circle no. A-13 on the business-reply card.*

The 1957 Reference Manual of Steel Equipment No. 485, a 48-page book, analyzes all types of steel shelving, drawers, lockers, work benches and tables, and other storage and shop equipment. For a free copy of the manual write Equipto, Division of Aurora Equipment Co., Aurora, Ill., mentioning SCHOOL SHOP; or *circle no. A-14 on the business-reply card.*

Catalog 200 describes and illustrates many of the stock-size Alnico magnets available from Park Magnet Company. Horseshoes, rods, bars, discs, and channels are shown together with dimensions and rated pulling power. For a copy of the catalog write the company, 1557 Green Bay Road, Highland Park, Ill., mentioning SCHOOL SHOP; *or circle no. A-15 on the business-reply card.*

1956-1957 Chilton Book Catalog lists, in its 64 pages, books and manuals in the automotive, insurance, refrigeration, automation, management, and industrials fields. For a copy write Chilton Book Division, Trade Department, Philadelphia 39, Pa., mentioning SCHOOL SHOP; or *circle no. A-16 on the business-reply card.*

Dreis & Krump's Bulletin No. 131-56 illustrates and describes, with complete specifications, the Model 131, 11-ton capacity Chicago press brake. This four-page bulletin may be had by writing to Dreis & Krump Manufacturing Co., 7400 S. Loomis Blvd., Chicago 36, Ill., mentioning SCHOOL SHOP; or *circle no. A-17 on the business-reply card.*

Essential Training for your drafting course of instruction is a six-page pamphlet published by the Universal Drafting Machine Corp., which gives tips on the use and need for learning to use a drafting machine. It offers examples of improved drafting efficiency, reasons why industry prefers machines to T-squares and triangles, and a analysis of drawing by construction as contrasted to direct drawing. For a copy of the pamphlet write to the Universal Drafting Machine Corp.,

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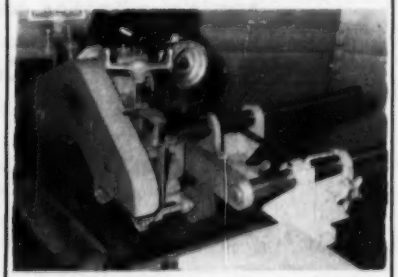

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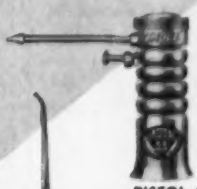

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7960 Lorain Ave., Cleveland 2, Ohio, mentioning SCHOOL SHOP; or *circle no. A-18 on the business-reply card.*

A new 32-page pocket-size catalog of the entire Walker-Turner "light-heavyweight" machine-tool line, recently published, combines illustrations of products and features with complete specifications. The catalog is said to be handy, easy-to-read, and filled with facts. For a copy write Walker-Turner Division, Pittsburgh, Pa., mentioning SCHOOL SHOP; or *circle no. A-19 on the business-reply card.*

Here Is a Way . . .

to publicize your industrial-education program

Fresh Ideas for "Printing Education Week"

Deciding that last year's Printing Education Week would be the best yet, teacher John M. Fontana and students in his printing class at Somers Junior High School, Brooklyn, N. Y., started to organize their planning early in the school year. The result was a week of well-planned, successful, integrated occasions, all promoting graphic arts.

Printing that needed to be done for the Week was accomplished first. Early in the school year, students tackled the jobs of printing the annual school calendar; designing and printing a two-color, four-page program listing activities for each day of the Week; completing a two-color dinner invitation with an envelope to match; an attractive dinner program with a decorative linoleum block and line cuts, printed in three colors; a place mat in three colors which included a prayer of Grace for Protestant, Catholic, and Jewish faiths; a tea invitation which went to the faculty and administrators; a printed invitation for parents to visit the school; and a bookmark with a twelve-month calendar on the back.

A Graphic Arts Club was formed with members being boys with a better than average aptitude for printing. A Benjamin Franklin Society was also organized with a member from each of the classes which had graphic-arts classes for the term.

Tying in with the idea, the English department conducted an essay contest on the topic "If Benjamin Franklin Lived Today." And the entire student body chose their candidate for the title of "Junior Miss of Graphic Arts."

Other activities which were successfully carried out included a pilgrimage to Benjamin Franklin's statue and a tour of a printing plant in downtown Manhattan, spot announcements over the school's loud-speaker, the showing of movies on printing to P. T. A. members, and printed posters placed in community stores in the neighborhood to advise the public of the activities. ★

Metal Shop . . . . . *from page 58*

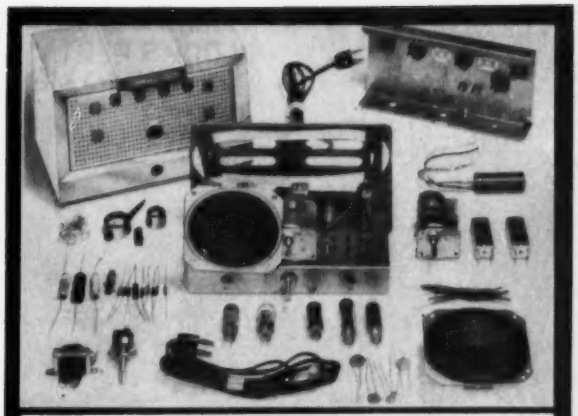
is stacked so only the backbone is in view. Loose materials, such as reference readings and illustration sheets, filed by subject in a filing cabinet are most easily kept in order. Standard filing cabinets can be altered without too much difficulty to allow some drawers to be unlocked and ready for use by students while other drawers can be locked for the storage of teacher records.

The foregoing ideas are but a few suggestions for the general metal shop instructor and are presented as a guide rather than a dictum. The intent is to promote the use of an overall plan and some imagination in its execution. There are many sources of suggestions on the details of storage planning. Design and arrangement of storage is rarely completely original — most systems have some original elements combined with tried and effective plans gathered from many sources.

No instructor plagued with a storage problem should be ashamed, for example, to consult with the students for ideas, and, in fact, he may develop several profitable lessons through such consultation. One successful method is to add a question at the end of a final examination requesting students to discuss difficulties they have had securing tools and materials and to suggest methods for overcoming them. A large majority of the students will come up with routine problems and routine answers, but there are always one or two who present ideas containing a fresh approach that has not occurred to the instructor.

Among other sources of aid are visits to other shops. The details of an idea often escape the memory without some type of note taking so the best method is to use the sketch pad or camera when visiting. Recently developed fast films make such photographic note-taking quite simple, even in poor light. Adaptation of ideas from designers, national magazines, industrial plants, and other sources can be worth the effort. All that is necessary is to keep the eyes and the mind open.

Instructors should take care to profit from the mistakes of others, as well as their successes. Oftentimes, as a matter of fact, instructors can obtain many ideas for good storage by observing examples of poor storage. ★



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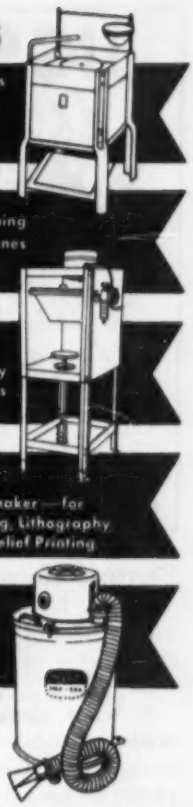

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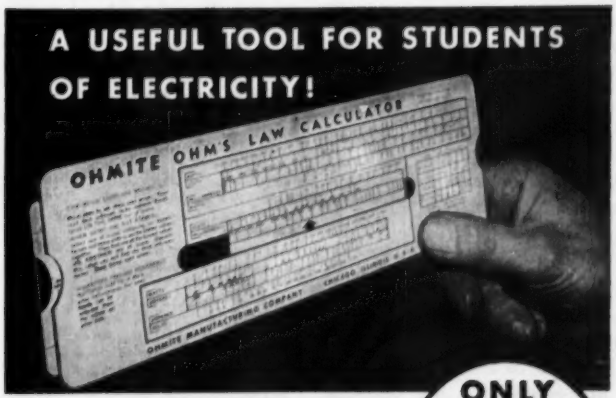

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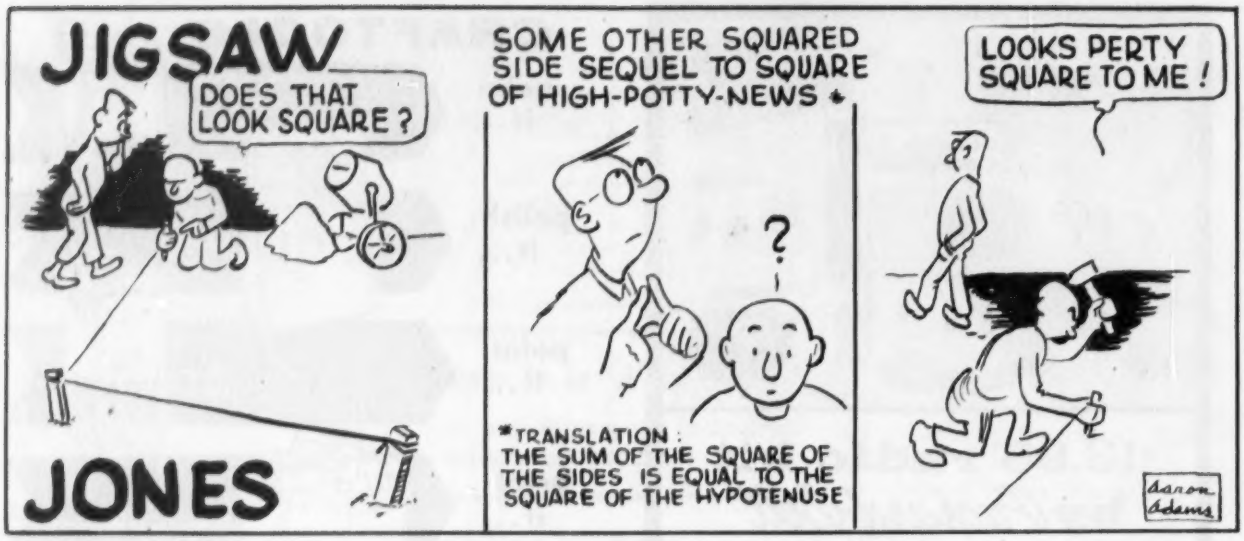
JIGSAW
DOES THAT LOOK SQUARE ?
JONES
SOME OTHER SQUARED SIDE SEQUEL TO SQUARE OF HIGH-POTTY-NEWS *
?
*TRANSLATION : THE SUM OF THE SQUARE OF THE SIDES IS EQUAL TO THE SQUARE OF THE HYPOTENUSE
LOOKS PERTY SQUARE TO ME !
Aaron Adams

Storage Helps . . . *from page 22*

6. Plan for project storage facilities within the shop by the inclusion of as many locker bases for benches as possible.

7. When additional storage space is needed, consider the possibility of shop storage balconies or overhead storage platforms hung from the ceiling along inside walls.

8. Plan for finished project display through the use of built-in and well-lighted display cases facing corridors. If possible, provide walk-in type access to the display cases.

9. Include shallow depth, overhead display units for sample and finished projects localized in the various work areas and the planning center of the shop.

The general and localized storage provisions for tools, materials, and projects for any shop program can only prove satisfactory if due thought has been given to the need for flexibility, efficiency, and safety.

Considerable emphasis should be placed on the importance of preplanning through the careful analysis of all types of storage needs for each shop. ★

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DONALD J. LANGLIE, of Uniontown, Pa., Vocational High School has been named director of vocational education for the Bradford, Pa., public schools.

S. C. "STOKLEY" ROBERTS, superintendent of the manual training department at Washington State College, Pullman, from 1901 to 1932, died recently.

RAYMOND V. NORD, formerly principal of Minneapolis, Minn., Vocational High School, has been appointed director of vocational education for Minneapolis, succeeding JOHN F. ROBOHM, retired.

EVERETTE W. ALEXANDER, principal of O'Fallon Technical High School, St. Louis, Mo., died unexpectedly in his sleep on January 19.

WILLIAM L. COOPER, senior coordinator of trade and industrial education for Western Pennsylvania, has been named chief of industrial education for Pennsylvania, succeeding GEORGE M. SCHAFFER, now director of the new Bucks County Technical School.

LESTER E. WILLIAMS has been named acting director of vocational education at Schenectady, N.Y., succeeding CHARLES W. CLARK, who recently retired.

JOSEPH C. PARK, former director of the industrial-arts division, New York State Teachers College, Oswego, died recently at the age of 84.

ALFRED E. DAVIES, formerly of Mohawk Technical Institute, Utica, N.Y., is now an associate in industrial education in the bureau of trade and technical education, New York State Education department, succeeding FRANK COYLE, now establishing a vocational school in Iran.

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Washington . . . . . *from page 140*

or might not do later, subcommittte chairman Bailey conducted hearings through February. He took testimony from a long parade of witnesses which included Secretary of Health, Education, and Welfare Folsom; former U. S. Commissioner of Education McGrath; and Edgar Fuller, speaking for the Chief State School Officers. They were all for a school construction bill. Then came the opposition, led, as usual, by the U. S. Chamber of Commerce. But representatives of taxpayers' groups and —note this—one or two school board officials also opposed the measure.

At no point was it clear which of the 21 bills introduced in the House were the witnesses supporting or opposing. There is, of course, H. R. One, the Kelley Bill, representing views of the Democratic majority. There is also the bill incorporating the proposals of Pres. Eisenhower, namely, H. R. 3986, written by Rep. McConnell of Pennsylvania. And as a compromise measure, there is the opus by Rep. Joe Holt, Republican from California. This measure, H. R. 4656, comes closest to meeting the views of the NEA and the U. S. Office of Education of what the school construction bill should be like. But these are only three—and the Bailey subcommittee is now in executive session reviewing 18 other bills, drafting and redrafting language to incorporate into a bill which will be acceptable to a majority of its seven members.

The best Rep. Bailey will be able to do, probably, is to come out with a version that he and his three Democratic colleagues will approve. In other words, the subcommittee may approve it by a vote of 4 to 3. If the bill were to then go directly to the House for a vote, it might have a 50-50 chance.

But no. The bill, if and when approved by the Bailey subcommittee, must next go to Chairman Barden and his full House committee on education. Mr. Barden is cool, very cool, to this or any other federal-aid measure at this time. He fears that any federal-aid law will promote—even if ever so gently—further desegregation in the public schools. He doesn't want that to happen. He will not lift a finger to push any federal-aid bill along to enactment.

The House committee on education, therefore, becomes an uncertain factor, if not a direct block to enactment. And then there is the rules committee, that powerful policeman which directs legislative traffic. It is quite possible these two committees may let the school-aid

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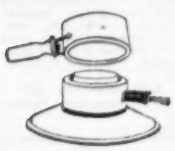

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measure go through. But if so, they will act without enthusiasm and certainly without strong support which a measure needs if it is to gain adherents on the floor. It is at this point that the House of Representatives will look to the White House. If the President remains passive, lukewarm, or mildly encouraging, the bill is doomed. Only if the White House puts on the heat will the bill pass the House; and after that, it will sail through the Senate.

Area Vocational Bill.—Sen. Talmadge is a Democrat from Georgia. Sen. Javits is a Republican from New York. Sen. McClellan is a Democrat from Arkansas. Margaret Chase Smith is a Republican from Maine. You probably couldn't assemble a group with a greater divergence of interests. Yet, when Senator Hill of Alabama asked each of the four if they would go along with him in introducing the area vocational bill of 1957, they said yes.

They—and 35 other Senators! The result is that the area vocational-education bill has one of the largest number of co-sponsors in the history of the Senate. The bill was introduced on February 20 by Mr. Hill with the remark that it "will help us win the economic war with Russia which is beginning to take form." It was then referred to the Senate committee on labor and public welfare. There it will remain—until the civil rights legislation and the school construction measure are out of the way. Then, when the strategists think the time is right, the measure will be brought out so that Congress can register its wishes regarding it. This may not be until 1958. However, there is some chance the bill may come to a vote before Congress goes home this coming summer.

If ever a federal educational measure was written with a minimum of federal controls—this may be it. Careful reading of the provisions shows the bill gives greater authority to states than any other previous vocational-education legislation. Under the Hill legislation (incidentally, its number is S. 1298), each state will decide for itself which occupations need training facilities and services, and who shall be eligible for training, and under what conditions. Officials in Washington believe the proposal, if enacted into law, will muster many out-of-school youth to training stations. They hope, too, that older persons will be attracted to the area vocational-training programs. Finally, it is the intent of the proposal to provide

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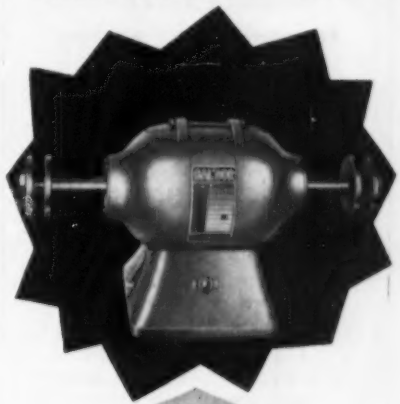

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Just what Section 13 is doing in the Hill measure is a bit of a mystery. This section authorizes $500,000 a year to states for supervision of industrial-arts education. Of course, industrial arts can be described as the matrix from which many sound vocational-education programs originate. On that basis, Section 13 has a legitimate place in the new proposal. But perhaps another reason is that industrial arts urgently needs state supervision and general strengthening. Federal support for such an effort is certainly imperative. But any proposal placed before Congress seeking the improvement of industrial arts by itself is politically not feasible. As part of a vocational-education bill, such a proposal has a good chance of success.

Labor's Vineyard Larger?—Well, now, what is the U. S. Labor Department up to these days?

It is planning to go into training in a big way. It is now setting up machinery and asking Congress for money to help "promote more adequate training programs throughout the economy."

What machinery and what money?

Secretary of Labor Mitchell told Congress he has taken steps to begin establishment of a Bureau of Apprenticeship and Training. He is asking for nearly $300,000 for next year to operate what he calls the new phase of the program.

What is the idea behind all this?

Mr. Mitchell's advisers have sold him the idea that industry is suffering and will continue to suffer from a shortage of skilled workers. Hence, Mr. Mitchell is telling Congress that if industry is to have the skilled people it needs now and will need by 1965, then industry will have to do much of its own training and retraining.

Where does the Labor Department think it fits in?

The Labor Department wants to carry out a program of "stimulation for effective training programs in all industrial occupations."

Over and above, and in addition to, apprenticeship occupations?

Precisely.

How, exactly, does the Labor Department plan to proceed?

The Department has assembled training materials developed by the Army, Navy, and Air Force. These materials have to do with instruction in more than 1000 jobs, occupations, or skills. The Labor Department believes industry can

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use these training materials and "the nation can thus get a vast amount of use out of the investment" made by the Department of Defense. In addition, the Labor Department would obtain training courses from private industry and from labor unions. The Labor Department function will be to locate, assemble, and advertise these materials. The department plans to set up training materials centers in several parts of the country and to use its local organizations (public employment services, for example) to maintain the collections.

Does the Labor Department propose to do any training itself?

Secretary Mitchell says, "No." He is on record before a House subcommittee on appropriations to this effect: "Training is a job for industry and educators. I think our function is to indicate the need for training—nationally—by particular areas, and by kinds of skills. I think, further, that our function is to stimulate business and industry to analyze their own needs, currently and for the future, in the expectation they will do something about it. And, where necessary, the Labor Department should provide technical assistance (within the limits of available resources)."

Does the Labor Department have authority to carry on these training activities?

Secretary Mitchell says the authority stems from an act of August 16, 1937, dealing with standards for apprentices; and from a Reorganization Plan, approved by Congress, which gives the Secretary of Labor authority to reshuffle functions and services in his department. If asked to do so, the Secretary would list other documents as his basis for action.

Do these really give him the authority he needs?

Many people in Washington and elsewhere do not believe so. Neither do officials in the Labor Department, apparently. A few years ago (in 1950) the Labor Department asked Congress for authority to become involved in the very activities the department now proposes to carry on without needed legislation.

What happened to that request?

Congress turned it down. That is why some vocational educators are asking: "Why was an effort made to get authority in 1950 for training activities if, presumably, the department had already had it?" And, "If the department needed legislative authority for training activities in 1950, why isn't it asking for it in 1957?" ★

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from Washington

by Michael Paca

A 50-50 chance.—To give you the gist of what's what with the school construction bill now pending in Congress, this reporter ventures the estimate that chances for its passage *now* are 50-50. By May or June, when the bill should near a vote in the House, the odds will go in favor of the bill going down in defeat — unless President Eisenhower begins to line up support for the measure at the right time and in sufficient strength.

The facts supporting this estimate are these: The fate of the bill is now in the hands of seven men. They are members of the House subcommittee on education. Three are Republicans, four, Democrats. The group is headed by Rep. Bailey, a Democrat from West Virginia. Mr. Bailey is a meticulous worker, an able legislator, but no inspiring leader. Mr. Bailey is serving as head of the subgroup because of the determination of Rep. Barden—chairman of the full House committee on education — that that honor shall not fall on Rep. Powell, Negro Democrat from New York who has seniority over Mr. Bailey. In this dispute brews only one phase of the disaster likely to overtake the bill.

Unmindful of what Mr. Powell might

(*Continued on page* 136)

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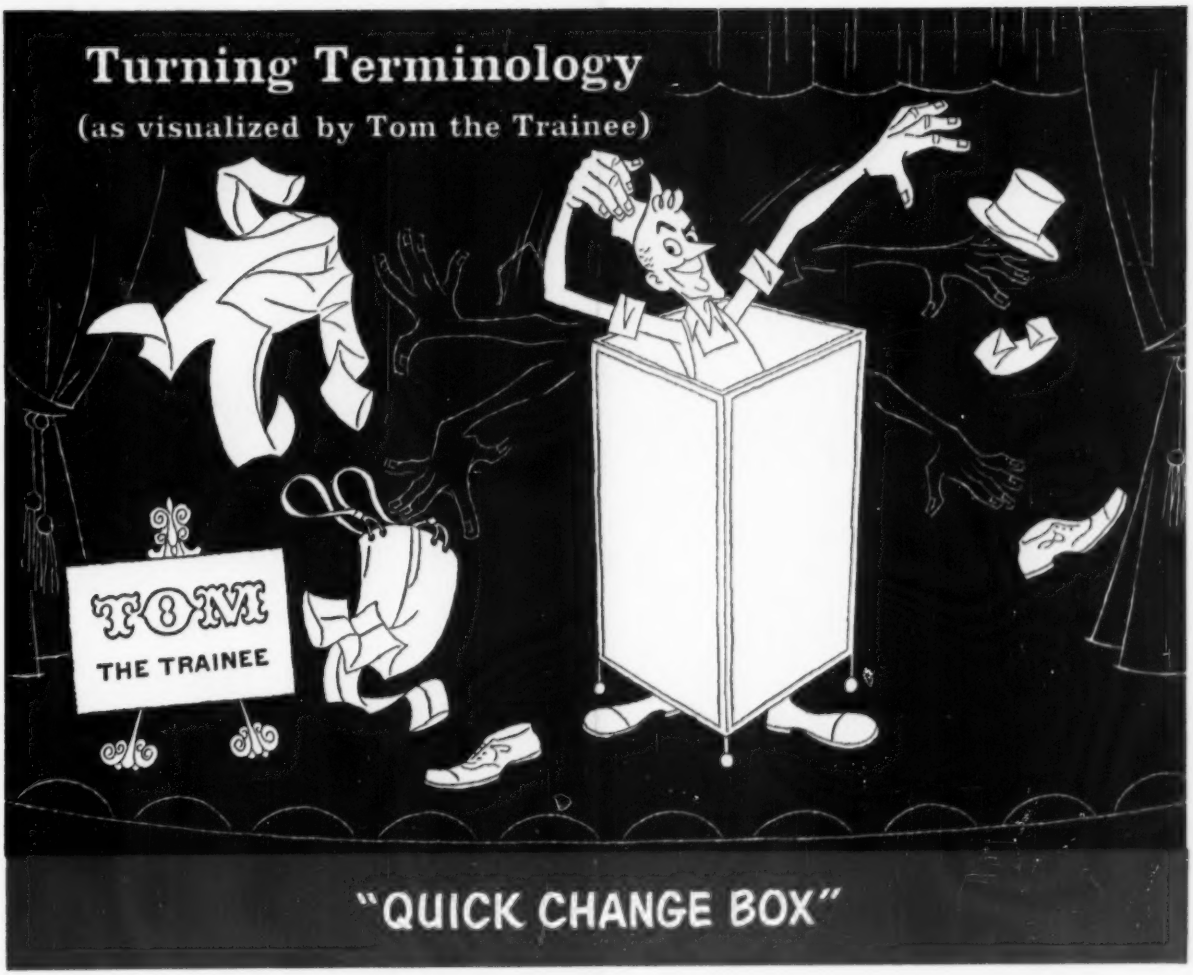

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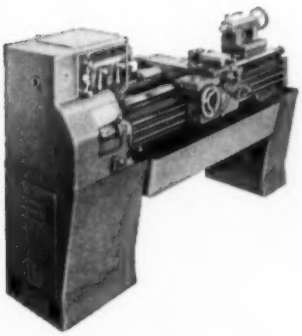

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